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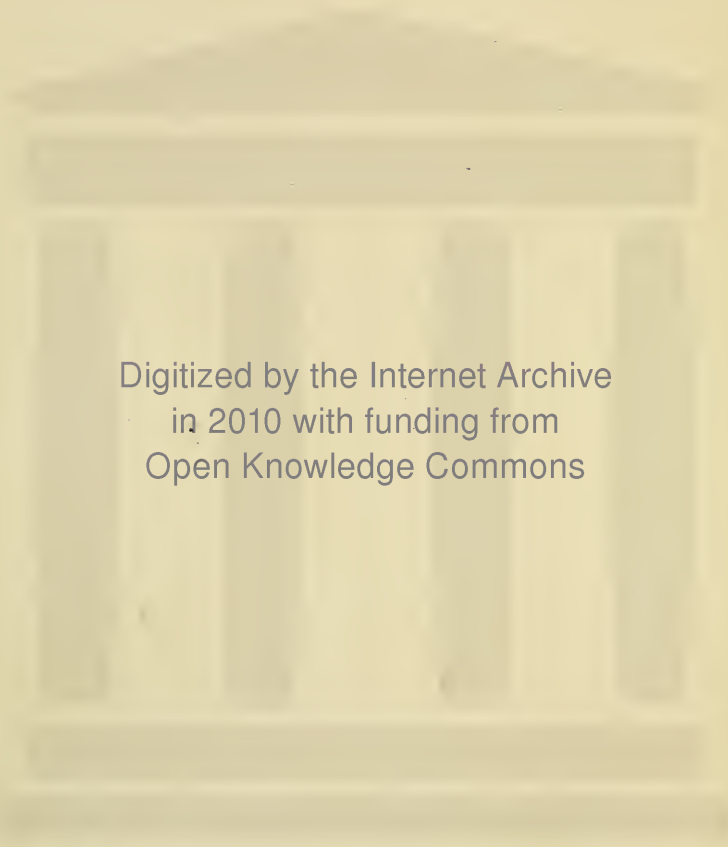
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• GONORRHŒA  
AND ITS COMPLICATIONS  
IN THE MALE AND FEMALE



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# GONORRHŒA AND ITS COMPLICATIONS IN THE MALE & FEMALE

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GLASGOW ROYAL INFIRMARY

LATE SURGEON GLASGOW HOSPITAL FOR WOMEN

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## PREFACE

IN English Medical Literature, the subject of Gonococcal disease has been treated with a quite unmerited neglect. The explanation is difficult to find. Gonorrhœa is one of the common ailments ; its immediate effects, in some cases, and its remote effects in many cases, are of serious import. I refrain from quoting here any figures relative to the prevalence of gonorrhœa, as no accurate data are available ; but that the incidence of the disease is a high one few will dispute. What is insufficiently realised in this country is the real gravity of the infection ; the many and serious troubles which the future has in store for a large proportion of those who contract gonorrhœa. The treatment of gonorrhœa is seldom adequate either in the male or female, and a frequent result is a chronic infective condition with its constant risks of exacerbations and complications, which, when they do occur, are only too frequently misinterpreted.

The author of a special treatise is open, with whatever measure of justification, to the charge of a perhaps involuntary tendency to exaggerate the importance of the subject which he has made his own. Quotations from the works of other specialists are equally liable to suspicion. More convincing will be the conclusions of such a careful writer as Professor Osler : "Gonorrhœa, one of the most widespread and serious of infectious diseases, presents many features for consideration. As a cause

of ill-health and disability, the gonococcus occupies a position of the very first rank among its fellows. While the local lesion is too often thought to be trifling, in its singular obstinacy, in the possibilities of permanent sexual damage to the individual himself, and still more in the 'grisly troop' which may follow in its train, gonorrhœal infection does not fall very far short of syphilis in importance."

The larger proportion of gonorrhœa practice is in the hands of prescribing chemists and of quacks, and for this the medical profession cannot be held blameless. We have looked somewhat askance at these cases and have failed to take the interest in the disease which it deserves. But the laboratory and clinical investigations, which have now been completed, and of which some account is presented in this volume, have established the diagnosis and treatment of the various manifestations of gonococcal infection on a scientific basis, and brought them within the sphere of the educated practitioner, where they, in common with all other ailments, rightly belong. The object of this book is to place at the disposal of the practitioner and the student a review of the work, as I understand it, of the many scientists and clinicians to whose labours any merit that this book may possess is due. During the past twelve years I have been fortunately placed so far as hospital and laboratory facilities are concerned and have thus been able to assimilate and corroborate the opinions expressed in the following pages.

With considerable regret, I have had to omit references to several books and papers to which I am indebted, but the resulting condensation has, I hope, increased the general as against the special utility of the volume.

An excellent bibliography will be found in "Handbuch der Geschlechtskrankheiten," edited by Drs. Finger, Jadassohn, Ehrmann and Grosz, which contains, by authoritative writers, the fullest description of gonococcal disease. Oberlaender and Kollmann's "Chronic Gonorrhœa and Its Complications," Luys's "Treatise on Gonorrhœa and Its Complications," and Norris on "Gonorrhœa in Women," are all books of the first importance on this subject.

I am indebted to Mr. H. W. Boot and to Mr. E. J. Burke for drawings of some of my specimens, and to the Matron of the Glasgow Lock Hospital and to Mr. Anderson of the Glasgow Royal Infirmary for photographs of cases, and also to Dr. W. Blair M. Martin, Dr. Norris, Dr. Chetwood, the Joint Committee of Henry Frowde and Hodder and Stoughton, and the publishers of the late Dr. R. W. Taylor's book "Sexual Disorders" for liberty to use illustrations.

DAVID WATSON.

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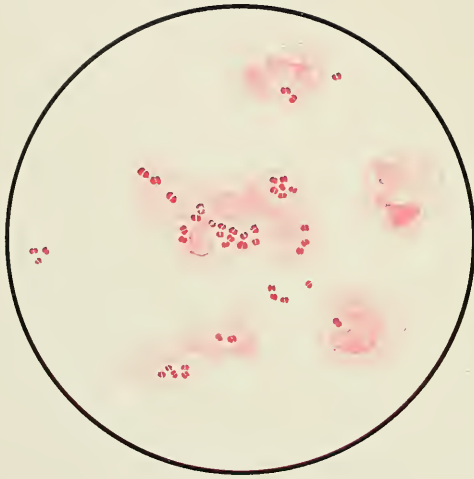
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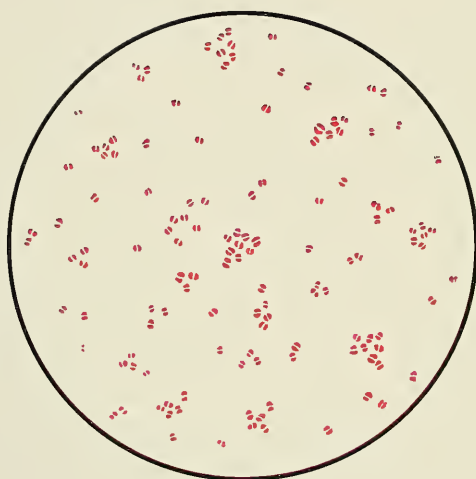
PLATE I.



Film of pus showing Gonococci (stained Gram and counterstained 1 in 10 Carbol-Fuchsin).



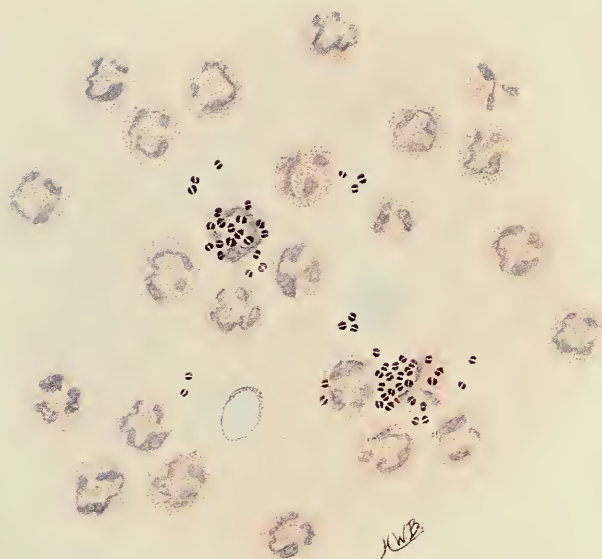
PLATE II.



Gonococci from Culture (stained Gram and counterstained 1 in 10 Carbol-Fuchsin).



PLATE III.



Pus showing Gonococci (Jenner stain).

# GONORRHŒA

## AND ITS COMPLICATIONS

### IN THE MALE AND FEMALE

#### CHAPTER I

#### HISTORY OF GONORRHŒA

THE history of venereal disease has attracted much attention from syphilologists within recent years, and it is now generally accepted that syphilis was introduced into Europe by the mariners of Columbus on their return from the New World in 1493. Gonorrhœa, on the other hand, was prevalent in Europe long before this period, references to this disease being frequent in the earliest writings. As the centuries passed, the conception in the minds of medical writers gradually attained greater clearness, until the intrusion of syphilis, when the identity of gonorrhœa was lost sight of and all venereal disease believed to be symptomatic of syphilitic infection. This error held sway, not undisputed, however, as will be shown later, until the painstaking investigations and brilliant writings of Ricord (1831–1860) finally overthrew the heresy and laid the foundation of our present knowledge of gonorrhœa as a specific venereal disease.

Gonorrhœa, a Latin word of Greek origin, is first found in the writings of Aretaïos of Cappadocia, a Greek physician who lived in the first or second

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century. There are, however, several passages in earlier literature which justify the inference that the disease was prevalent as far back as history can be elucidated. Thus the Papyrus Ebers, the oldest medical Egyptian record, contains prescriptions to be used as injections for genital affections, which suggest the occurrence of gonorrhœa among the Egyptians. Proksch states that in a Japanese manuscript of 900 B.C. there is a vivid description of gonorrhœa. Celsus (25–35 A.D.) speaks of the disease as a flow of seed “*sine venere vel nocturnis imaginibus.*” That the Jews were not immune is proved by verses one to thirteen of the fifteenth chapter of Leviticus, and this reference is free from the erroneous belief regarding the nature of the discharge which influenced Aretaios in adopting the misnomer “Gonorrhœa.”

Aretaios describes gonorrhœa as, “A very disagreeable and disgusting disease which arises in consequence of debility of the sexual organs. Involuntarily the semen flows night and day, thin, colourless, and unfruitful. When young people suffer they develop an appearance of age, become lethargic, feeble, spiritless, and pallid. To prevent wasting of the body and loss of the power of reproduction, gonorrhœa must quickly be removed.” The function of the testicle was of course unknown, the semen being believed by the Hippocratists to be a product to the formation of which the whole body contributed.

Alexander of Tralles (525–605) still considered gonorrhœa a discharge of semen, but he divides the causes into two groups, (*a*) those due to continence after former sexual excess, and (*b*) uninterrupted excess. In the latter case, he said that the discharge was acrid and irritating.

Towards the end of the sixth century some idea of inflammatory affections of the urethra developed, and mention is found of pyuria, hæmaturia, and dysuria. Paul of Ægina noted urethral bleeding and suppuration without admixture with urine.

Avicenna (980–1037) and his contemporaries are to be credited with some advance in the comprehension of this question. Avicenna describes two kinds of urethritis, (*a*) one in which the urethra is bared by too frequent coitus of its protecting mucus and in which there is not a flow of suppuration but of semen, and (*b*) one in which, owing to internal ulcer or abscess, there is discharge of pus and blood accompanied by burning sensations. He remarked that the first type frequently merged into the second.

Subsequent to A.D. 1000, more correct descriptions of the disease are met with, and we find coitus suggested as a cause. Maimon, the Jewish theologian, philosopher, and physician of Cairo (1139–1204) mentions several causes of gonorrhœa, and includes amongst these lasciviousness and licentiousness. The discharge he describes as being essentially different in its nature from semen and mucus. Valescus of Taranta (1380–1420) writes: “Not only is gonorrhœa harmful to the individual, but to the whole human race, because if all men suffered from gonorrhœa soon would the whole race perish.” Roger (thirteenth century) details the symptoms of gonorrhœa as pain, burning, redness and swelling of the penis, and difficult urination. Guillaume de Salicet (thirteenth century) attributed the onset of gonorrhœa to impurities retained under the prepuce after connection with an unclean woman. He was the first to suggest prophylactic washing. John of Gaddesden also recommended cleansing with acidu-

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lated water after impure cohabitation. The first mention of suspensory bandages is found in his book.

These extracts enable us to comprehend the views current on the subject of gonorrhœa previous to the advent of European syphilis in the last decade of the fourteenth century.

Paracelsus, in 1530, had begun to teach that gonorrhœa was an initial symptom of syphilis, but not until twenty years later did this theory gain support, and another half-century elapsed before it was universally adopted. The history of gonorrhœa thereafter merges into that of syphilis, and this unfortunate misconception held sway until finally overthrown by the excellent work of Ricord begun in 1831 and continued until 1860.

As a sample of the accepted doctrine in the seventeenth century, Wiseman, Surgeon to Charles II, may be quoted. In his publication, "Chirurgical Treatises," Treatise VIII, in which there are six chapters, is headed "Of Lues Venerea," and the last two chapters are devoted to "Gonorrhœa" and "The Ill Consequences of Gonorrhœa" respectively. While the diseases are confused as regards their etiology, they are nevertheless described separately. One of his definitions is as follows: "A virulent gonorrhœa is an involuntary emission of seed, occasioned by venom contracted from an unclean woman." While recognising forms of gonorrhœa other than that associated with syphilis, he says: "It is this species that is the most usual employment of our profession, the diseases of those parts being most frequently gotten by the too predominant vice of the age." The misconception of a common cause led to mercury being prescribed in cases which were purely gonorrhœal, but as a rule Wiseman had re-

course to mercury only in obstinate cases. Of the many marvellous combinations of drugs for which he gives prescriptions the outstanding constituent apart from purgatives is turpentine. He used astringent pills and injections, but to milk, which seems to have been popular as a urethral injection, he objects, on account of its liability to clot in the bladder. He recognised prostatic abscess, epididymitis—for which he enjoined the use of a “bag-truss”—and stricture, which he ascribes to uncured “caruncles,” and for which he used medicated candles and lead probes. He described perineal section for impermeable stricture, leaving, however, a permanent fistula. He shows considerable ingenuity in making his keen clinical observations fit in with traditional belief.

During the eighteenth century several writers threw doubt on the veracity of the “Unicist Doctrine” of Venereal disease, e.g. Cockburn (beginning of eighteenth century), Francis Balfour (1767), Charles Hales (1770), N. Ellis (1771), I. C. Tode (1774), and Andrew Duncan (1777). In 1793 Benjamin Bell published his treatise on “Gonorrhœa Virulenta and Lues Venerea.” By inoculation experiments on two of his students who volunteered their services, he proved that gonorrhœa and syphilis were distinct diseases.

All efforts at advance, however, were nullified by the personal experiment, in 1767, of the great John Hunter, who unhappily succeeded in contracting both syphilis and gonorrhœa from an inoculation of impure gonorrhœal pus. His prominence in the medical world caused his teaching to be widely accepted, and the efforts of his few opponents to be of little avail, until the middle of the eighteenth

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century, when Ricord succeeded in convincing the profession of the duality of gonorrhœa and syphilis. Ricord failed to recognise the specific nature of the gonorrhœal virus, and maintained that various sources of irritation, e.g., lochial and leucorrhœal discharge, alcoholism, etc., could produce the disease, thus confusing gonorrhœa with what is now known as "Urethritis Simplex." Ricord was misled by having frequently noticed on examination that a man became infected with an acute urethritis while the woman with whom he had cohabited was free from appreciable disease. By his discovery of the gonococcus in 1879, Neisser settled all speculation on this subject.

While still in the unicist era of confusion with syphilis, the advance in anatomical knowledge gradually led to a better understanding of the local pathological conditions. Thus, Tourquet de Mayerne (1573-1655) proposed to call the disease "puorroia," and William Cockburn (1715), and Morgagni (1719) assisted in establishing that gonorrhœa was a urethritis and comparable to inflammation of other mucous membranes; but it took many years to displace the erroneous doctrines current in their time which relegated the site of the disease to the seminal vesicles, vas deferens, prostate, or Cowper's glands.

## CHAPTER II

### BACTERIOLOGY OF GONORRHOEA

THE first successful attempt to find the causative organism of gonorrhœa was that of Neisser. While assistant in the Breslau Skin Clinic in 1879, he published an article entitled "On a Characteristic Micrococcus of Gonorrhœa," in which he described the microscopic appearance of the gonococcus as seen in urethral and conjunctival pus. Neisser's discovery was rendered possible by the previous work of Weigert and Koch, who had introduced the process of bacteria staining. His observations were confirmed by others, but all attempts to grow the organism on artificial media failed until Bumm, in 1885, successfully used solidified serum derived from the human placenta. The separation of the gonococcus in pure culture enabled experimental inoculations to be undertaken on the human subject, and the successful issue of these operations conclusively demonstrated the causal relationship of the gonococcus to the disease. Wertheim simplified the process of culture by introducing a serum agar medium, and blood agar or serum agar is now in common use as a culture medium.

*Microscopic appearance of the gonococcus.*—The gonococcus belongs to the diplococci group. In outline it is plano-convex or bean-shaped, and the pairs lie with their concave or plane surfaces opposing, as shown in Plate II, leaving usually a distinct space

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between the cocci. They can be recognised in unstained films, and are well seen by dark field illumination. They have no capsule, have no power of movement and do not form spores. There is considerable variation in size, but the average measurement is  $1.3\ \mu$  in length and  $.7\ \mu$  in breadth. The cleft between the diplococci is one-fifth of the breadth of a coccus. Sometimes two adjacent cocci differ in size, and considerable variation from the standard occurs. In purulent secretion they are usually numerous in the pus cells, but they are also found free or adhering to epithelial cells. Degenerated cocci may be seen in convalescing or chronic cases. These differ from the normal coccus in shape, size and power of absorbing stains, but are said to be still capable of producing an acute gonorrhœa.

*Staining of gonococci.*—The gonococcus readily absorbs any of the basic anilin stains, e.g., methylene blue, gentian violet, fuchsin, etc. It is, however, easily decolorised with alcohol, acids, xylol, and other reagents, and thus, in staining by the Gram process, it is Gram-negative, losing the gentian colour and taking up the counter stain, e.g., fuchsin. Many special methods of staining gonococci are described, but by far the most important is the Gram's stain, as it differentiates the gonococcus from all Gram-positive organisms. To prepare a smear in a suspected case of gonorrhœal infection in the male, cleanse the external parts, and while the meatus is pressed open, pass a small bulbous-pointed probe wrapped with sterile cotton-wool into the urethra and smear the secretion so obtained on a thin glass slide. If, on account of extreme tenderness of the urethra, it is not advisable to use a probe, the meatus and surrounding parts should be thoroughly cleansed with

alcohol; a drop of secretion is then expressed from the canal and transferred to the slide by direct contact. The pus is spread on the slide in the same way as in making a blood film.

In the adult female, material should be taken both from the urethra and the cervix. In females it has been considered difficult to get a smear sufficiently free from contaminating bacteria to be of much use for diagnostic purposes, but if the following method is adhered to it will seldom fail, even in chronic cases. After cleansing the external parts with sterile water, the urethra is treated as in the male. The cervix is displayed with a speculum, the external os wiped clean with wool, and the cervical canal is once or twice gently but firmly swabbed free from secretion and surface organisms. A third probe carrying sterile wool (or a platinum spoon) is then used to collect the material from the lining epithelium of the canal, and this is applied to the slide.

The smear when dry is fixed by passing it three or four times through the flame of a spirit lamp or by use of the Ehrlich plate, and is thereafter stained as follows (Weigert-Gram):—

1. Stain for three to five minutes with carbol-gentian-violet.
2. Dry with blotting-paper.
3. Treat for one or two minutes with Gram's Iodine Solution.
4. Dry with blotting-paper.
5. Decolorise with anilin-xylol (anilin oil recently distilled 2 parts, xylol 1 part).
6. Wash with xylol.
7. Allow to dry.
8. The cell elements and those bacteria which become decolorised, in other words the Gram-

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negative organisms, are now stained with diluted carbol-fuchsin (1 to 10 of water) for ten seconds.

9. Wash in water (gently running tap).
10. Allow to dry.
11. Mount in xylol balsam, if permanent specimen desired.

Under the oil immersion lens the appearance of the smear will vary according to the site from which it has been obtained and the stage of the disease. Thus the smear from the male urethra, if taken in the early stage of the disease before there is much pus present, will consist of mucus, epithelial cells, leucocytes, and various micro-organisms. The normal urethra has been said to entertain as many as sixteen varieties of saprophytes, which remain innocuous until inflammatory processes are set up either by mechanical irritation or by the gonococcus. These include the bacillus coli, staphylococci, streptococci, etc. They are confined to the pars anterior, the posterior urethra being germ-free. One Gram-negative diplococcus, which is not the gonococcus, is found in 4 per cent of urethras; another diplococcus, not, however, Gram-negative, is frequently found in the male urethra. But for all practical purposes, the discovery of a Gram-negative coffee-bean-shaped diplococcus is diagnostic of gonorrhœal infection. The possibility of confusion with another organism with the same morphological characters to be found in this locality is so remote as to be negligible, in the ordinary circumstance of admitted exposure to infection.

In the early or mucous stage of gonorrhœa, the gonococci are for the most part extracellular, and will be found lying free in pairs or groups of diplococci. In the middle or purulent stage many pus cells will be

seen containing clumps of gonococci. Cells are occasionally seen crammed with them, and sometimes, owing to the rupture of one of these cells, a group which has in appearance been compared to a swarm of bees will be seen in the field. In the convalescing stages the gonococci are more difficult to locate, and a whole smear may contain only one characteristic pair, or several smears may have to be searched before any gonococci are discovered.

In the case of the cervical smear, gonococci are usually identified without any difficulty, unless in old standing cases, and then several attempts may be necessary, or some artificial method of stimulation may have to be adopted to demonstrate their presence. The urethral smear in women, whose infection has been of remote occurrence, may be positive even when the cervical smear has failed to give positive evidence, and this is especially true of cases complicated by external venereal warts. Smears from the cervix are often very mixed, if the preliminary dry cleansing has not been thoroughly carried out.

A short description of the various organisms likely to be found in smears from the female may be helpful. The *Bacillus* of Doderlein is the prominent figure in a smear from the healthy vagina, and a few are usually seen in a cervical smear. Their absence from the vagina may be due to antiseptic treatment or to their having been crowded out by contaminating organisms. Doderlein and his followers attribute to this bacillus an active part in the protection of the vagina from invasion by other bacteria, and they ascribe its antiseptic powers to the lactic acid which it produces. The freedom of the vaginal walls from gonococcal infection is probably due to Doderlein's *Bacillus*, as in children, where the vaginal flora has not yet

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appeared, the vaginal walls are not immune. Under the microscope the Doderlein Bacillus is seen to be a Gram-positive organism occurring singly as well as in short chains of from two to four. A vaginal smear showing numbers of these large bacilli and but few other organisms is suggestive of a healthy condition of the parts. It is a serious drawback to rigorous antiseptic treatment that it entails destruction of this organism, although the substitution of the lactic acid bacillus to a considerable extent meets this difficulty. The other organisms which may be encountered are, for the most part, Gram-negative small and large bacilli and Gram-positive cocci. In addition to the ordinary pyogenic staphylococci and streptococci, the micrococcus catarrhalis and pneumococcus are occasionally, though rarely found. The bacillus coli is one of the Gram-negative bacilli frequently present, and bipolar staining, which it sometimes shows, may give it an appearance suggestive of the gonococcus.

Anærobic Gram-negative bacilli occur in large numbers in many cases of vaginal discharge secondary to gonococcal infection, and these organisms may survive after the disappearance of the gonococci. They are liable to induce balanitis when inoculated on a male with a tight prepuce.

Gurd has described a "*diplobacillus vaginae*," which is commonly present in vaginal smears. It is short, thick, and somewhat lanceolate-shaped, and occurs in pairs with the broad ends approximated. Being Gram-negative, it has a superficial similarity to the gonococcus. Innumerable other organisms, many of them chromogenic, are found in vaginal smears. Owing to morphological similarity, confusion may arise between the gonococcus and the micrococcus

catarrhalis and its chromogenic homologues. The meningococcus also has an identical microscopic appearance and staining reaction, and can only be distinguished by cultural methods. It has not been found in the genito-urinary tract. Some member of the micrococcus catarrhalis group, commonly found in the respiratory passages, may on a rare occasion be met with in inflammatory conditions of the male and female genitalia. Microscopically, they appear somewhat larger than gonococci, but only by cultivation can these organisms be differentiated.

In order to stimulate into activity and thus enable one to find the gonococci in cases of long standing, whether in male or female, various methods of irritation may be adopted. Locally the application of strong solutions of silver salts, instrumental dilatation, massage, etc., will frequently bring gonococci again into prominence. I have found that the injection of gonococcus vaccine has the same effect during the "negative phase."

Flakes and threads found in the urine can be cautiously dried on a slide and the urine salts removed by washing. Urine for examination should be as fresh as possible. It is centrifugated; the deposit washed in physiological saline and recentrifugated.

It is not always necessary to use the Gram method of staining, e.g., in following the result of treatment in a case in private practice. The most rapid method would be to stain with methylene blue either in a watery solution plain or with addition of borax; or Loeffler's Solution may be used. The stain is quickly absorbed, and the specimen is then washed in running water and dried with blotting-paper, the whole process being completed within one minute. The

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gonococci are deeply stained blue, sometimes so deeply as to appear almost black, the cell protoplasm but slightly stained blue, and the nuclei are distinctly blue. Even a dilution of 1/1000 of methylene blue gives quite good results (Bronnum).

When it is desired to retain the cell elements as slightly altered as possible, the films may be made by placing a minute drop of pus on a cover glass and superimposing another clean cover slip. The two slips are separated by sliding them apart, and are allowed to stand edgeways until dry. They are then placed in equal parts of absolute alcohol and ether for fifteen minutes, which coagulates the albumen and "fixes" the specimen. Treat according to Gram's method, but instead of merely counterstaining with fuchsin, a more complete picture can be obtained by putting the films into methylene blue for one minute, washing until most of the blue has disappeared, counterstaining in a watery solution of eosin for twenty to thirty seconds, washing, drying, and mounting. In this case the gonococci retain the blue stain and the cells the eosin.

Loeffler uses a stain composed of—

4 parts of borax methylene blue.

1 part polychrome methylene blue.

5 parts .05% bromeosin B.

He exposes the preparation to the action of this solution for one minute, with slight warming, and then decolorises with—

Alcohol, 177 parts.

Solution of bromeosin (1 in 1000), 20 parts.

Acetic acid, 3 parts.

Pick and Jacobsen recommend a solution consisting of—

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Distilled water . . . . .	20·0 c.c.
Carbol-fuchsin . . . . .	20 drops.
Concentrated alcoholic methylene blue solution . . . . .	8 „

To be applied for eight to ten seconds. Wash in water. Dry. Gonococci will be darker than other bacteria.

The Pappenheim process is—

5% Carbolie water solution of Methylene green (concentrated)	2·0
Pyronin . . . . .	1·0–3·0

Stain from three to five minutes. Nuclei blue-green to lilac, cocci dark red, protoplasm of cells rose-red.

Krzyształowicz has modified the above so as to shorten the exposure to twenty to thirty seconds. His solution is—

Methylene green . . . . .	0·15
Pyronin . . . . .	0·25
Alcohol . . . . .	2·5
Glycerine . . . . .	20·0
2% Carbolie water . . . . .	to 100

The Schaffer method is—

Dilute carbol-fuchsin (composed of fuchsin 0·1, alcohol 20·0, 5% carbolie water 200·0) 5 to 10 seconds. Wash.

Ætheline - diamin - methylene - blue solution (composed of concd. watery solution of methylene blue 2 to 3 drops, and 1% Ætheline-diamin 10 c.c.) 40 seconds.

Dr. A. von Wahl suggests a new stain which he says acts strongly on the gonococcus, and is particularly useful in cases of chronic urethritis and for sections. Its composition is—

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Saturated alcoholic auramine solution .	2	c.c.
Alcohol (95%) . . . . .	1-5	„
Saturated alcoholic solution of thionin .	2.0	„
Saturated watery solution of methylene green . . . . .	3.0	„
Distilled water . . . . .	6.0	„

Expose to the action of the stain for five to fifteen seconds. The cellular elements are coloured light green and the gonococci dark violet.

Jenner's stain procures a good picture of gonococcal pus.

The Gram method, however, still holds its position of prominence as the most useful stain for the gonococcus. That the gonococcus is Gram-negative was first shown by Roux in 1886. Many modifications have been tried to improve on the original procedure, and some are of decided advantage. The anilin water solution of gentian violet being unstable, has to be prepared anew every few days. It has therefore been displaced by the carbolic water solution (1 part satd. alcoholic solution of gentian violet mixed with ten parts 5 per cent solution of carbolic acid). Methyl violet is preferred by some to the gentian violet. In decolorising, methylated spirit is better than absolute alcohol, but Weigert's method is best of all. He uses a mixture of anilin oil two parts, to xylol one part, and washes this off with xylol. Anilin-xylol decolorises very quickly. A few drops are poured on the specimen and allowed to flow off in a few seconds. This is repeated once or twice, and the process is completed by washing the oil away with plain xylol. When, on the first addition of the anilin-xylol, no gentian dissolves, one of two faults requires correction, (a) the specimen is too dry, or (b) the anilin is impure or old. The former

can be overcome by breathing on the film, the latter requires a freshly distilled anilin oil. The xylol dries off rapidly if allowed to stand, and the smear is then ready for counterstaining. Where spirit is used for decolorising, this is usually complete in about thirty seconds. When no more colour is removable, the gonococci are always stain-free, and the specimen should never be exposed any longer than two to three minutes to the action of the alcohol. The readiness with which the gonococcus parts with the Gram's stain is influenced somewhat by the nature of the fluid in which it is suspended. Thus Neisser found that a film from a pure culture required fifteen to twenty seconds, from pus twenty to thirty seconds, and from mucoid vaginal secretion sixty seconds or more.

While an organism is said to be Gram-positive if it retains the stain after the latter has been completely removed from the tissues, it must be remembered that some tissue elements may retain the stain as persistently as any bacteria, e.g., keratinous epithelium, calcified particles, the granules of mast cells, and sometimes altered blood cells, etc. (Muir).

As a counterstain, carbol-fuchsin (Ziehl-Neelsen), diluted with ten to twenty volumes of water, applied for a few seconds, or a saturated aqueous solution of Bismarck-brown, will stain gonococci red or brown respectively. Degenerating gonococci tend to become spherical and swell to an unusual size. These are usually Gram-negative, but are indistinctly stained.

Vital-colouring, i.e., the staining of living gonococci, can be effected by neutral red (Uhma). Bibergeil succeeded with various basic aniline stains. F. Winkler rubbed finely ground dyes (neutral red, pyronin, fuchsin, etc.) into the urethra and found

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that the extracellular as well as the intracellular cocci were well coloured and the intervening space between the cocci well defined.

By Plato's method the living gonococci in fresh pus cells can be rapidly recognised. His solution, which should be prepared immediately before use, consists of—

Saturated watery solution of neutral red . . . 1 c.c.  
Normal saline solution . . . . . 100 „

A drop of pus is mixed with a loopful of the stain and examined under a cover glass. Only the intracellular gonococci are stained, other organisms, whether intracellular or extracellular as well as the extracellular gonococci and leucocytes, remaining uncoloured.

*Staining of sections.*—Tissue sections can be stained by the Gram, the Wahl, or the Unna-Pappenheim process. The two latter, while staining the gonococci distinctly and differently to the tissues, has no discriminating value for the gonococcus as against other organisms.

*Gram method recommended for sections.*—

1. Stain with gentian violet for five to fifteen minutes according to the density of the tissue.
2. Treat with two or three floodings of Gram's solution and allow the last application to remain for one or two minutes. The tissue is now purplish black.
3. Dry with blotting-paper and decolorise with anilin-xytol. Wash with xytol and allow to dry.
4. Counterstain the Gram-negative organisms with dilute carbol-fuchsin for thirty seconds, and wash.

5. Dehydrate completely in absolute alcohol, clear with xylol, and mount in xylol-balsam.

As a contrast stain for the tissues, carmalum or carmine may be used before beginning the above process.

The following is the Unna-Pappenheim method—

Methyl-green (Grubler)	.	.	0.15 gm.
Pyronin	.	.	0.50 „
Alcohol (96 %)	.	.	5.00 c.c.
Glycerine	.	.	20.00 „

Stain with gentle heat (incubator) for four or five minutes. Wash in cold distilled water. Dehydrate quickly in absolute alcohol and clear with xylol. Mount in xylol-balsam. The gonococci are stained red and the cell nuclei blue.

The stain suggested by Wahl has already been described.

*Cultivation of the gonococcus.*—Neisser's work with the gonococcus did not include success in its artificial cultivation. This was reserved for Bumm, who, in 1885, succeeded in growing colonies on solidified blood serum derived from the human placenta. The next investigator to announce any important advance on Bumm's methods was Wertheim (1891). He used peptone agar and human serum, two parts of the former to one of the latter. The serum, at a temperature of 40° C., is inoculated with the gonorrhœal pus, mixed with fluid agar also at a temperature of 40° C., and the mixture plated and incubated. By this method colonies of the gonococcus may be isolated in cases of mixed infection and pure growth obtained by subculture. The trouble involved in getting sterile human serum in sufficient quantity suggested the trial of ascitic, pleuritic, or hydrocele

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fluids, but owing to the variations in their albumen content and in their alkalinity, they are found in practice to be somewhat less reliable. Blood agar (Abel) has been largely tried on account of the ease with which it can be prepared (simply smearing the surface of an ordinary agar tube with a few drops of blood from a pricked finger), but it is of little practical value. Successful attempts have been made to grow the gonococcus on various animal sera, but uniform results have not been obtained by different observers. Urine agar in the proportion of one to two is recommended by Finger and others. Fluid media have not proved of much value, although pure cultures can, if desired, be grown in ascitic or hydrocele fluids or serum broths.

An analysis of the many papers which have been published on the subject of gonococcus cultivation (as well as one's own experience) shows vividly how little uniformity can be obtained by different workers with any of the above media. The most recent work, however, has, I think, demonstrated some essential points which must be considered in the choice of a medium if the results are to be accepted as of absolute diagnostic value.

Of primary importance is the reaction of the medium. Either alkalinity or acidity if sufficiently marked are inhibitive of gonococcal growth. A reaction as nearly identical to that of blood serum as it is possible to attain is the ideal, i.e., the medium should be only slightly acid to phenol-phthalein (0.6 per cent). The medium must also contain a small proportion of uncoagulated serum albumen which has been heated to 57° C., in order to destroy its bactericidal properties. A consideration of these points has enabled Blair Martin to compile a formula

which, in my experience, has proved a very reliable medium. Martin's agar is prepared as follows :—

“ A beef extract is prepared as usual. To it are added 0·5 per cent of di-sodium phosphate, 1 per cent of Witte's peptone, and 2 per cent of powdered agar. The mixture is placed in a Koch's steriliser, and after the agar has melted the medium is titrated while still hot. For this purpose I take a 5 c.c. sample of the medium, add two drops of a  $\frac{1}{2}$  per cent phenolphthalein solution, and then run in a one-twentieth normal sodium hydrate solution from a burette till a faint but permanent pink colour, which distinctly deepens on cooling, appears. This is taken as the end-point, and if the medium is of the correct degree of acidity (0·6 per cent acid to phenolphthalein or 6·0 on Eyre's scale) 0·6 c.c. of soda solution will have been used (with the above proportions). In practice, however, more alkali is at first required : suppose 2 c.c. were used, then the medium is 1·4 per cent (2—0·6) too acid. This is corrected by adding to the medium in bulk normal sodium hydrate solution in the proportion of 1·4 c.c. to each 100 c.c. of medium (usually rather more than the calculated figure is actually requisite). The reaction having been adjusted, the medium is filtered, tubed, and sterilised as usual. Care should be taken to avoid prolonged cooking, as this causes a darkening of the medium, which, by masking the tints, increases the difficulty of titration. Also, if white of egg is used for clearing purposes, allowance must be made for the fact that it is usually more acid than the medium. When properly prepared the agar is practically colourless, and it should also possess only a moderate amount of water of condensation. Too moist or too dry a medium is a fault.”

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On the surface of each agar tube Martin runs three or four drops of sterile human serum which has been kept at  $57^{\circ}\text{C}$ . for an hour and a half. When the process is completed the tubes are incubated for twenty-four hours to ensure that they are sterile. This also allows the serum to dry on the surface of the agar.

Plating, except in the case of articular effusion, has no advantage over slants, and it introduces a possibility of failure in the fact that the medium has to be heated. Martin adds 0.2 c.c. of serum to the melted agar after it has been cooled down to  $45^{\circ}\text{C}$ . Before being inoculated it has to be further cooled down in the thermostat to  $40^{\circ}\text{C}$ ., as the gonococcus is very susceptible to heat, surviving only ten minutes in a temperature of  $44^{\circ}\text{C}$ . and being almost immediately destroyed at  $45^{\circ}\text{C}$ . (Marcus).

Another trustworthy medium is Gurd's modification of Duval's formula. This medium is prepared as follows :—

“A base is prepared of agar-agar 2 per cent, peptone 1 per cent, sodium chloride .5 per cent added to the beef infusion. This is corrected to .6 per cent acid to phenol-phthalein (hot titration) before sterilisation in the autoclave. To the tubed sterile agar, melted and cooled to a temperature of  $52^{\circ}\text{C}$ ., is added a small quantity of defibrinated sterile human blood. From four to seven drops of blood are added to each six to ten cubic centimetres of agar. The tubes are thoroughly shaken and slanted or poured into Petri dishes. By this means a beautiful bright crimson, almost transparent, medium is obtained with a moderate amount of water of condensation. If the agar is hotter than  $60^{\circ}\text{C}$ . when the blood is added, the hemoglobin is destroyed and a dirty brownish-

coloured material is the result. If the agar is too cool, there will be no water of condensation. If the medium be kept for one or two weeks before being made use of, growth is more profuse and characteristic. The water of condensation may be conserved by dipping the corks in hot sterile paraffin."

With this medium Gurd says that he has never failed to obtain growth from cases in which the presence of the gonococcus could be otherwise demonstrated, provided that antiseptics have not been too vigorously used.

The usual method of procuring human blood is, after severance of the cord at a confinement, to allow the placental end to bleed into a sterile bottle containing a few glass rods. When sufficient blood has been collected it is defibrinated by shaking. The defibrinated blood is used for Gurd's medium, and the serum, after separation of the corpuscles by the centrifuge, for Martin's. A simpler method of obtaining serum for Martin's or other similar medium, is to run the blood into a sterile test-tube, allow it to clot, and pipette off the resulting serum into sterile tubing which is sealed in the blow-pipe. Store until required.

Either of the above media can be used, confident that if gonococci are present in a suspected case and the infected material is collected and applied to the tubes with careful observation of the necessary precautions, colonies will have appeared in twenty-four hours. The method of procedure in taking the swabs has already been described on page 8. The same swab does for inoculating the culture tube and for making a smear for microscopic examination. The tube of medium, previously warmed in the incubator, receives treatment precedent to the slide, two or

## 24 GONORRHOEA & ITS COMPLICATIONS

three successive strokes being applied to the slope. Particular attention has to be paid to rapidity. The swab dries quickly, and in addition to the fact that the gonococcus soon loses its vitality if allowed to dry, difficulty would be experienced in seeding the tube and also in smearing the slide with a dried swab. The most satisfactory procedure is to inoculate the tube and obtain the smear direct from the patient, and with as little delay as possible to place the tube in the incubator. The tube should be kept from drying by a rubber cap or by dipping the projecting wool plug in melted wax. If an hour or two must elapse before the incubator is reached, some method of maintaining the tube at blood heat should be adopted. The half-pint thermos flask holds a tube comfortably, and cotton-wool placed in the bottom of the flask moistened with water at 38° C. is the plan I prefer for the conveyance of inoculated tubes.

The optimum temperature for gonococcal cultivation is 36° to 37° C. Above 41° C. and below 32° C. no growth takes place. The minimum at which it has been stated to retain its vitality is 15° C., and the maximum 44° C., but it is probable that different strains behave differently in this respect.

The appearance of the colonies varies according to the medium on which they are grown, therefore in the following description I have confined myself, for the sake of definiteness, to the appearance as seen in using Martin's medium, and have largely drawn on Martin's valuable article published in the "Journal of Pathology and Bacteriology," vol. xv., 1910, as it is entirely in accordance with my own observations when following his methods. The colonies are, as a rule, visible in eighteen to

twenty-four hours and are full grown in forty-eight hours.

“They are minute, semi-transparent, slightly elevated discs presenting to the naked eye a moist-looking glancing surface. When examined with a low-power lens, they are almost transparent, of a light greyish-yellow colour with transmitted light. They are homogeneous, the ground substance being finely granular, and they have definite uniform margins which, under a high-power lens, are seen to be very slightly toothed. As the colonies enlarge they tend to remain discrete; the centre thickens and gets more opaque, owing to the development of numerous ovoid coarse granulations; and the margins become scalloped instead of remaining circular (forty-eight to seventy-two hours). Then, owing to a radial plication of the colony, radial striations develop, and concentric rings, due to zones of different degrees of opacity, also appear. Finally, in about a week, still coarser granulations become visible as points of supergrowth throughout the colony, and many attain a considerable size. They are often so white and opaque in contrast to the rest of the colony as to suggest to the uninitiated contaminations, but when examined at an early stage with a low-power lens the appearance is exactly that of a superimposed daughter colony. When touched with a platinum loop the growths are readily removed from the medium: they have a distinctly viscous consistence, but they are neither slimy on the one hand nor tenaciously viscid on the other, and cultures fairly readily emulsify.”

Gurd describes the colonies on his blood agar as follows :—

“The colonies are usually well developed in

## 26 GONORRHOEA & ITS COMPLICATIONS

eighteen to twenty-four hours, although occasionally they take forty-eight hours to reach their maximum size. When fully developed they generally appear as raised watery-looking bluish-grey, or almost colourless, semi-transparent, small round colonies with a moderately well-defined outline. The colonies, as a rule, in seventy-two-hour cultures, show a tendency to spread out from the periphery in a more or less irregular manner. Upon the surface of the blood agar the appearance of the growth is very characteristic and readily distinguished.

“As a rule, the colonies measure about .8 millimetre in diameter. Sometimes they are extremely small, being scarcely visible in the initial tube. Upon several occasions, too, in which the organism was proven culturally and clinically to be the gonococcus, the colonies measured from two to four millimetres, being very irregular in size and of a definitely bluish-grey colour closely resembling the characteristic colonies of the meningococcus. In all cases the subcultures from such colonies gave the characteristic fine watery growth. It would appear that certain bodies in the fluid in which the organisms were suspended either inhibited or assisted the subsequent growth of the colonies.

“A characteristic of the growth of the gonococcus which is more marked upon blood agar than on other media is its tenaciousness. This difficulty in the removal of colonies is especially marked in colonies from eighteen to thirty-six hours old. This characteristic is also met with in the cultivation of meningococci.”

Gurd's cultures when kept at room temperature were, in most instances, dead within a week. It will be noted that Martin's description of the colonies

differs somewhat from that of Gurd. Particularly, his measurements are greater, and he describes certain characteristics which are not evident in using Gurd's medium. Martin, however, admits that with regard to the scalloped margins, radial striations, concentric rings, and granular centre considerable differences are evident in individual specimens. Any of these characters may be wanting, but a combination of some of these appearances with the grey-bluish-white colour and moist transparency of the colony serves to differentiate the gonococcus from similar colonies and renders a diagnosis possible by cultural appearances.

A mixture of ascitic, pleuritic, or hydrocele fluid one part, and ordinary nutrient agar two parts, is largely employed for the growth of the gonococcus, and when these effusions can be obtained an excellent and reliable medium can be composed, provided the reactions of both of the constituent parts are carefully adjusted. The medium I now prefer for primary culture of the gonococcus direct from the patient is made as follows :—

Liebeg's extract of beef	.	.	.	.	·3 %
Peptone	.	.	.	.	1 „
Acid phosphate of sodium	.	.	.	.	·5 „
Glycerine	.	.	.	.	3 „
Agar	.	.	.	.	2 „

The acidity of this agar is reduced by the addition of sodium hydrate solution to a point which varies according to the reaction of the ascitic or hydrocele fluid in stock, but it is usually about ·3 to phenolphthalein. In reaction these transudates are usually slightly alkaline to litmus, but acid to phenolphthalein, the degree varying from ·05 to ·8. It is

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therefore necessary to titrate the serous fluid as well as the agar, in order to know what the total acidity of the completed medium will be. The reaction of the medium should not exceed  $\cdot 6$  degree of acidity, but may be as low as  $\cdot 2$ . Being a colour test, doubtless there is some variation in the standard of different workers. The melted and tubed agar is cooled to  $56^{\circ}$  C., and a portion of the serous fluid is then added in quantity equal to half the volume of agar. The tubes are sloped and afterwards incubated in an inclined position to ascertain their sterility and to encourage the exudation of water of condensation and the fixation of the agar to the glass. This medium improves on keeping.

When the material for inoculating the tubes is obtained as already described, a good growth can be anticipated on this medium in positive cases. Colonies appear in sixteen to eighteen hours as minute and almost transparent, crystal pinheads. The growth of other organism seems to be delayed, so that it is advisable to subculture early to obtain a pure culture. To keep a strain going on this medium, it is only necessary to subculture once in three weeks.

On agar, as a rule, no growth appears. On a rare occasion, especially in cases where there is little or no contamination, some colonies may develop. Where this happens it is probably dependent on the transference during inoculation of some albuminous nutrient material along with the micro-organisms. After the growth of some generations on serum or blood agar, subcultivation on agar is more readily obtained. Thalmann's agar, which is a simple meat-broth agar, neutral in reaction, is used after the addition of 2 per cent of glucose as a medium for the subculture of gonococci for experimental purposes, as

the presence of serum in the medium complicates the results in sensitive reactions such as the complement deviation test. A plain veal agar gives better but still scanty growth.

Requiring a large supply of gonococcus extract and finding the usual serum-free media unsatisfactory, Hirschfelder arrived at the following formula, which he says removed all difficulties :—

“Two hundred gm. of bullock’s testicle, ground with a sausage-grinder, were boiled with 1000 c.c. of water made alkaline with sodium hydroxid, so that 10 c.c. required 1 c.c. tenth-normal acid to neutralise to phenol-phthalein. This was filtered, and 1 part of this testicular extract was added to three parts of agar prepared as follows :—

Veal bouillon . . . .	gm. or c.c. 1000
Saturated solution of sodium phosphate made neutral to phenol-phthalein with phos- phoric acid . . . .	„ 100
Agar . . . . .	„ 30

Agar so prepared can be autoclaved, and on it the gonococcus grown readily.”

On ordinary gelatine no growth takes place, but Turro says that a scanty growth of delicate colonies can be obtained at 22° C. for two or three generations on gelatine which has not been neutralised and is therefore acid. No liquefaction occurs.

Of fluid media perhaps the best is that recommended by Bruschettini and Ansaldo :—

Sterile beef broth . . . .	10 c.c.
Defibrinated blood . . . .	1 drop
Fresh white of egg . . . .	1 „

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Vannod prefers a veal broth to which is added one-third its volume of ascitic fluid. By the second day the medium has become cloudy, but later it is cleared by the deposition of the growth at the bottom of the vessel.

To maintain a robust growth of any particular strain, weekly subcultures are advisable, as the organisms soon show evidence of spontaneous autolysis, increasing considerably in size and losing their affinity for stains.

There appears to be some doubt as to whether the gonococcus can survive without oxygen. Wertheim and Du Mesnil maintain the affirmative, while Vannod and others assert that it is an obligatory aerobe. An atmosphere of hydrogen hinders, but does not prevent growth. In vacuum, Vannod found cultures sterile in one hour, but this may have been due to mechanical injury of the cells.

From urine seven hours old R. Stein succeeded in growing gonococci, but in nine-hour urine the organisms had lost their vitality, due, he suspects, to the presence of some bactericidal agent in the urine.

Films from cultures show the characteristic coffee-bean diplococcus, but tetrads are not uncommon. Considerable variation in size of individuals may be seen in one field.

Degeneration forms are early present in culture films. They may be spherical in shape and either markedly swollen or, on the other hand, they may be atrophied and shrunken. When a culture is ultimately composed only of such forms, it is still capable (according to Wertheim, Herman, and others) of regeneration on transplanting to a fresh soil, but this assumption is open to the criticism that the new growth may be due to normal individuals being present which have escaped recognition.

## DESCRIPTION OF PLATES IV, V, AND VI

(From the "Journal of Pathology and Bacteriology," Vol. XV., July, 1910.  
W. Blair, M. Martin.)

## PLATE IV

- FIG. 1.—*Gonococcus* (K.S.), stroke culture, 1 day's growth. Note the extreme transparency of the growth. ( $\times 9$  diameter.)
- FIG. 2.—*Gonococcus* (S.), stroke culture, 5 days' growth. The semi-confluent nature of the growth and supergrowth granules are shown. ( $\times 9$  diameter.)
- FIG. 3.—*Gonococcus* (O.N.), 3 days' growth. Note the granularity of the centre. There is slight radial striation, but the margin is comparatively circular. ( $\times 9$  diameter.)
- FIG. 4.—*Gonococcus* (W.), 3 days' growth. Note the granular centre, the scalloped margin, and the radial and concentric striation. ( $\times 9$  diameter.)
- FIG. 5.—*Gonococcus* (K.C.), 3 days' growth. Note the granular centre and the general plicated nature of the colony. ( $\times 9$  diameter.)
- FIG. 6.—*Gonococcus* (C.), 3 days' growth. Note the granular centre and the extreme plication of the colony. ( $\times 9$  diameter.)
- FIG. 7.—*Gonococcus* (H.), 5 days' growth. ( $\times 9$  diameter.)
- FIG. 8.—*Gonococcus* (K.S.), 5 days' growth. Note the extreme degree of marginal scalloping. ( $\times 9$  diameter.)
- FIG. 9.—*Gonococcus* (V.), 5 days' growth. A highly typical gonococcus picture is presented. Contrast with Fig. 10, which shows another colony of the same strain grown on the same plate. ( $\times 9$  diameter.)
- FIG. 10.—*Gonococcus* (V.), 5 days' growth. To contrast with Fig. 9. There is much less differentiation, and the colony was more opaque as seen with the naked eye. ( $\times 9$  diameter.)

## PLATE V

- FIG. 11.—*Gonococcus* (K.C.), 13 days' growth. The granular centre, the plication of the colony, the radial and concentric striations, and the scalloped margin are all shown. Note commencing supergrowth granulations forming a zone where concentric striation is most marked. ( $\times 7\frac{1}{2}$  diameter.)
- FIG. 12.—*Gonococcus* (K.C.), 13 days' growth. Contrast with Fig. 11. These colonies were grown on different plates. Here there is a greater degree of granularity in the centre, causing opacity, and supergrowth granulations are more marked, but concentric striation is less evident than in Fig. 11. ( $\times 7\frac{1}{2}$  diameter.)
- FIG. 13.—*Gonococcus* (C.), 10 days' growth. The granularity of the centre is limited. The dark circular shadow is due to a large supergrowth out of focus. The plication of the colony has given the optical effect of lily leaves. ( $\times 7\frac{1}{2}$  diameter.)

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### PLATE VI

FIG. 14.—Gonococcus colony appearances, drawn by Mr. A. K. Maxwell. A light and shade stereoscopic effect impossible with direct photography is thus obtained.

(a)	Gonococcus (K.C.),	2 days' growth.		
(b)	"	"	5	" "
(c)	"	"	12	" "
(d)	"	(T.)	2	" "
				showing tendency of colonies to remain discrete.
(e)	"	(T.)	12	" "
				showing supergrowth.
(f)	"	(K.C.)	12	" "
				showing few but large supergrowths.

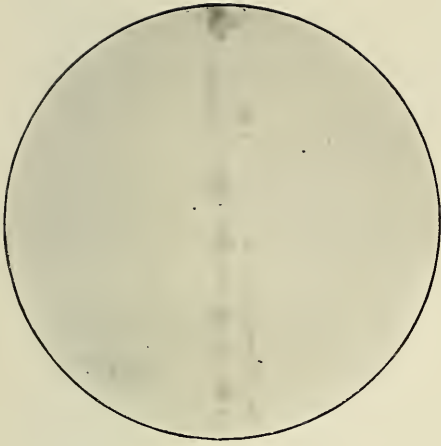
FIG. 15.—Gonococcus (K.C.), 6 days' growth. Note comparative translucence of whole colony. A series of supergrowths are forming a ring midway between margin and centre. (The dark central shadow is due to the inoculating point having cracked the surface of the medium.) ( $\times 9$  diameter.)

FIG. 16.—Gonococcus (K.S.), 10 days' growth. Naked eye this colony was rather opaque and without central granulation. Note, supergrowths have appeared at one place near the margin. ( $\times 9$  diameter.)

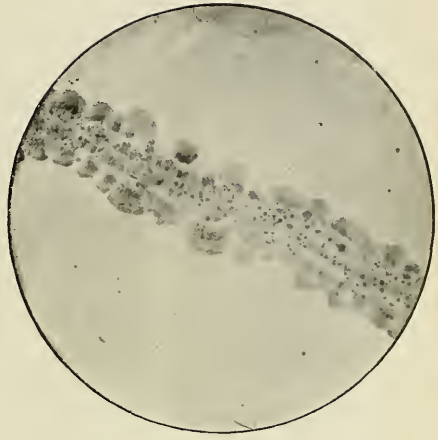
FIG. 17.—A typical arthritis organism, 7 days' growth. Note extreme plication of the colony and its comparative opacity. Coarse granulations are visible on the surface. ( $\times 9$  diameter.)

FIG. 18.—A typical arthritis organism, 13 days' growth. Note the well-marked coarse granulation of the central portion. ( $\times 7\frac{1}{2}$  diameter.)

PLATE IV.



*Fig. 1.*



*Fig. 2.*

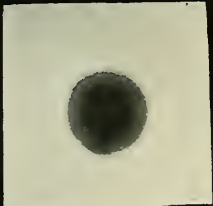


Fig. 3

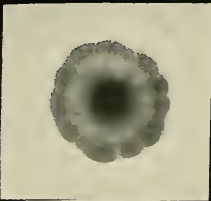


Fig. 4

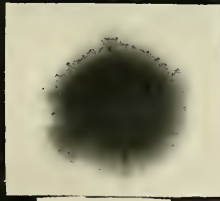


Fig. 5

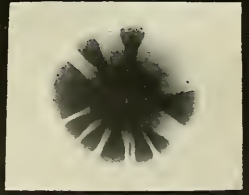


Fig. 6



Fig. 7

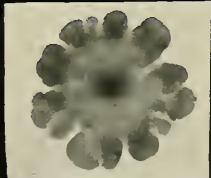


Fig. 8

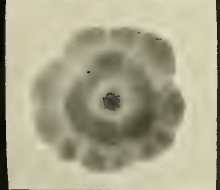


Fig. 9

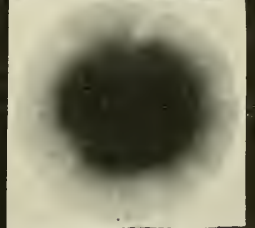
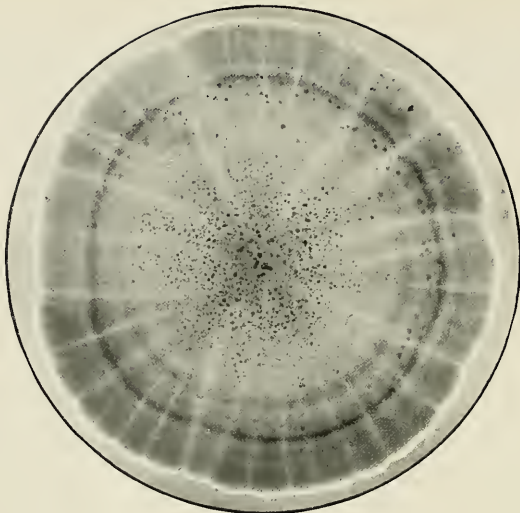
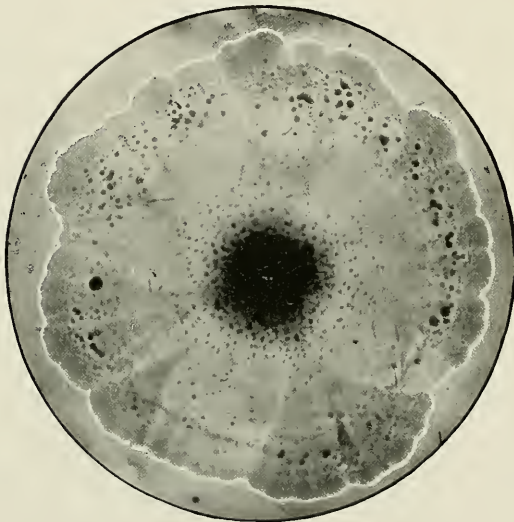


Fig. 10

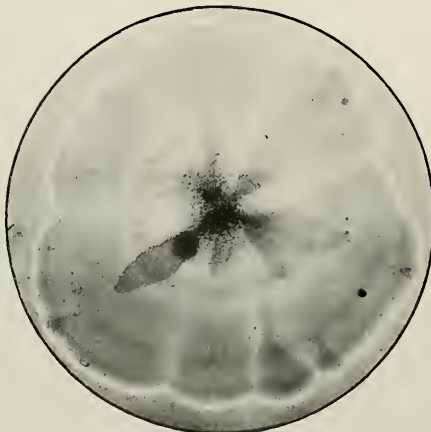
PLATE V.



*Fig. 11.*

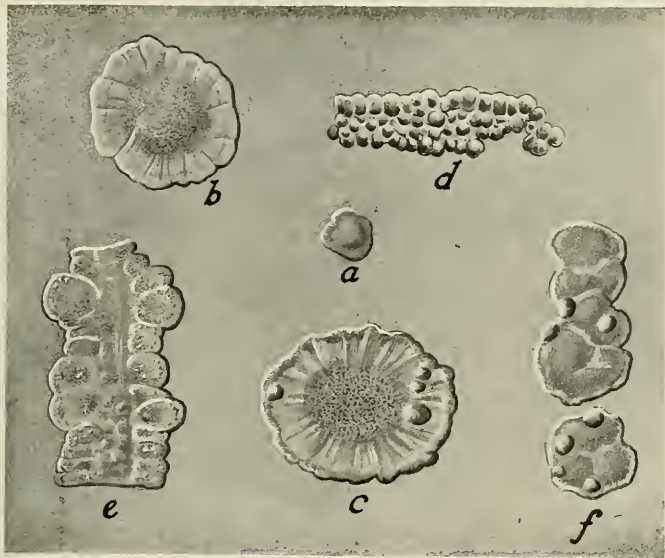


*Fig. 12.*

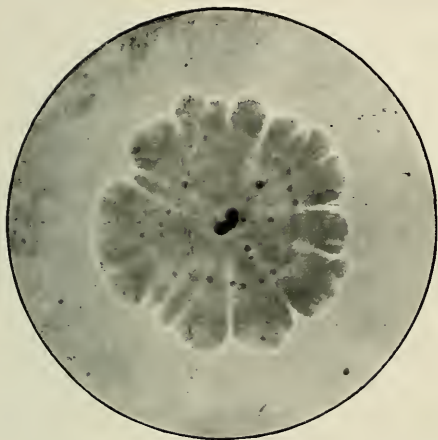


*Fig. 13.*

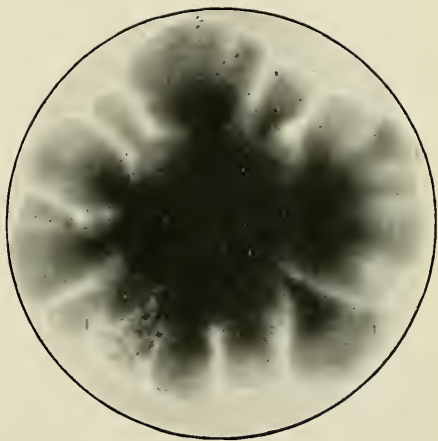
PLATE VI.



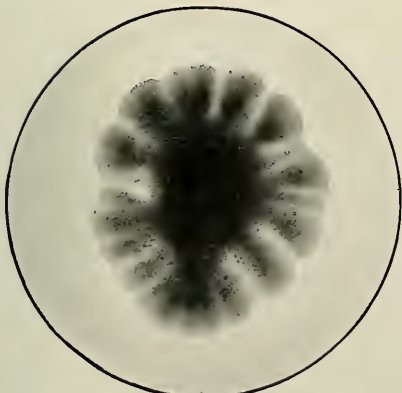
*Fig. 14.*



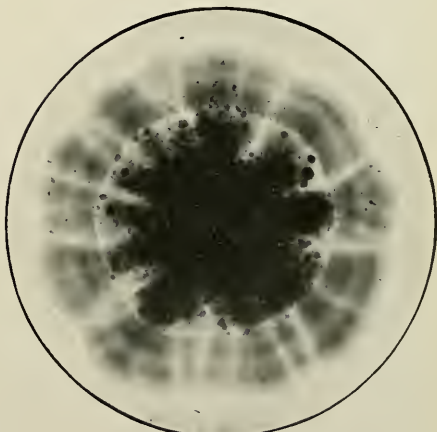
*Fig. 15.*



*Fig. 16.*



*Fig. 17.*



*Fig. 18.*



## CHAPTER III

### PATHOLOGICAL HISTOLOGY OF GONOCOCCAL INFLAMMATION

TISSUE changes which are characteristic of bacterial infection follow the trail of the gonococcus. Wherever the organism is found the phenomena of inflammatory reaction are soon apparent.

The gonococci in the first instance grow on the surface of the epithelium. The production of toxine by the surface colonies is followed by hyperæmia and serous exudation. As a result, the cylindrical epithelial cells become swollen and loosened, and they are cast off in considerable numbers. Small blood-vessels are seen crammed with leucocytes, and diapedesis and phagocytosis are soon in active progress producing the characteristic purulent discharge. Polynuclear leucocytes, mononuclear leucocytes, and plasma cells are deposited in the subepithelial tissue, the concentration of these wandering cells being greatest immediately subjacent to the epithelial layers.

Between the interstices of the separating cylindrical epithelium, gonococci find suitable conditions for growth. They are found in rows around the cells, but never actually within the epithelial cells. Epithelium of the squamous type is more resistant to the gonococcal toxine, and while colonies flourish on the surface, they have no chance of becoming insinuated into crevices between and beneath the cells in contradistinction to what occurs in

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the case of cylindrical epithelium ; and therefore so long as they are confined to the fossa navicularis, gonococci are exposed to the action of abortive antiseptic treatment. In the case of cylindrical epithelium, gonococci readily reach the corium and frequently also its submucous tissue. On the surface they are carried into the lacunæ and the gland ducts, where, being beyond the reach of injected antiseptics, they may remain for indefinite periods in susceptible individuals. If they succeed in penetrating any long gland tubule the surrounding corpus spongiosum becomes infiltrated.

In the epithelial layer are found many polynuclear leucocytes, while in the connective tissue lymphocytes preponderate, and their number is greatly increased as the gonococci reach into the depths of the corium. Wherever gonococci penetrate the infiltration is intense, and the abundance of the infiltrating cells varies in proportion to the number of organisms.

As the gonococci pass along the lymph channels they set up more or less lymphangitis. Endarteritis has also been proved, and occasionally thrombophlebitis has been noticed.

The organisms embedded in the tissues are nearly all extracellular, but occasionally some are seen in the interior of a polynuclear leucocyte. The only cells which absorb gonococci are the polynuclear neutrophile leucocytes ; mast cells and eosinophile cells never show gonococci in their protoplasm. The intracellular position becomes more common nearer the surface, but phagocytosis is most active of all in the lumen of the urethra. This is proved by the observation that the discharge obtained at the meatus shows a much greater proportion of intracellular

gonococci than is found in smears collected from the surface of the mucous membrane after the passage has been cleansed by the act of micturition.

As the purulent stage subsides the denuded areas of epithelium are regenerated in the first place by the growth of layers of flattened epithelial cells. There may be at certain spots many layers of squamous cells heaped up in such a manner as to form minute excrescences. These are ultimately shed in flakes, and when all irritation has been removed the flattened epithelium is finally replaced by healthy cylindrical cells.

In the process of healing two factors are concerned, namely, a new deposition of resistant squamous epithelium and the production of antibodies. The squamous epithelium prevents any recruiting of the tissue-embedded gonococci from the surface. The toxine produced by the interstitial gonococci is diverted into the ordinary channels of absorption instead of escaping in the exudation through the disintegrated mucosa. Reaching the blood stream it acts as a natural vaccine stimulating the formation of antibodies, the presence of which in the serum makes it not only an unsuitable medium for the growth of the gonococcus, but brings about the destruction of the organisms. In this way it may be suggested the gonococci disappear, and eventually by the action of the plasma cells the infiltration also becomes absorbed.

*The pathological changes in chronic urethritis.*—There is unfortunately a distinct tendency in a considerable proportion of cases for the processes which are productive of cure to stop short of completeness and for the gonococcus to maintain its existence in certain areas although its activities are restrained.

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In chronic urethritis gonococci are most frequently found in gland ducts where they may maintain a subdued activity for indefinite periods, extending sometimes to years, but they may also survive for some time in the depths of the mucosa. In either situation they are not within reach of local antiseptic treatment, and the difficulty of exterminating the organisms is much increased. The intraglandular situation of the gonococci explains the marked tendency to the periglandular localisation of the infiltrated areas so noticeable in chronic gonococcal urethritis.

In the presence of a continued irritation the surrounding infiltration, instead of becoming absorbed, undergoes a series of changes which, unless they are checked, result eventually in the formation of cicatricial tissue. New blood-vessels find their way between the infiltrating cells, and the latter are gradually replaced by newly formed connective tissue cells. The next retrograde change is marked by the appearance of white fibres, and the new granulation tissue becomes insidiously converted into cicatricial tissue. The over-production of connective tissue cells with subsequent formation of connective tissue fibres is the characteristic histological change in chronic urethritis, and it is of the greatest clinical significance.

Clinically, the different stages are recognised as "soft" and "hard" infiltrations, and the final cicatrix in unfavourable cases results in the production of a stricture. In acute gonorrhœa the infiltrated areas are of the soft variety, and in the early chronic stage little change is manifest; but as time goes on, if the irritation is still maintained, fibroblasts make their appearance, with later a deposit of fibrous tissue. These histological changes

are accompanied by the physical changes indicated by the nomenclature of the above classification, viz., soft, hard, and cicatricial.

When the gonococci are confined to a gland or lacuna the orifice may become occluded, in the early stages, by the swelling of the œdematous and infiltrated mucosa or by a plug of hardened detritus, and in the later stages by contraction of the newly-formed fibrous tissue or adhesions of the eroded duct walls. A cystic abscess is the result, and this can be felt as a tensely firm body varying in size from a caraway seed to a pea or even larger. These pseudo-abscesses usually rupture into the urethra, and their alternate filling and emptying is occasionally the explanation of mild exacerbations. When this pus formation is limited, the contents of the cyst tend through time to become sterile, in which case a nodule may remain or it may become absorbed, leaving only a minute scar.

The intrusion of other organisms, "mixed infection," increases the risk of the production of a true abscess, the cyst wall being destroyed. Such an abscess will, on a rare occasion, point externally, when a troublesome fistula may be anticipated.

Another effect of cicatricial contraction in the neighbourhood of a gland is gaping of the orifice.

On examining through the urethroscope, chronically infected glands may thus present as small bulging cysts, as dilated and reddened openings, or remnants only can be seen as minute cicatrices.

The curative changes in the epithelium may be retarded or may be exaggerated. The piling up of numerous layers of squamous cells, the most superficial of which are frequently keratinised, produces callosities projecting beyond the level of the surround-

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ing mucous membrane. The epithelium is shed in flakes of considerable size, and overlying certain areas of infiltration, erosions or patches of granulation tissue are sometimes found.

The histological pathology of post-gonorrhœal disease is identical with that of late chronic gonococcal urethritis, the essential distinguishing feature being the absence of the gonococcus.

## CHAPTER IV

### ACUTE GONOCOCCAL URETHRITIS IN THE MALE

ACUTE catarrhal inflammation of the urethral mucous membrane in the male is in the great majority of cases due to invasion by the gonococcus. A "simple" urethritis in which the gonococcus is not the causative agent is not of very rare occurrence, and it will be considered in a later chapter; but at the present day no difficulty can be encountered in arriving at a definite diagnosis, as in every case both diagnosis and treatment should be controlled by bacteriological examination.

On the occasion of an impure coitus, the gonococcus is implanted from an infected urethra or cervix into the urethral canal of the male, at once reaching, in all probability, the fossa navicularis, to which for a time its location is limited. The epithelial lining of the fossa navicularis being of the squamous type and resistant to the gonococcus, the organism lives on the secretions in the canal. At this stage it is therefore easily destroyed or removed by suitable prophylactic treatment. The gonococcus itself having no power of movement is dependent for its reception into the navicular fossa on the suction action which follows ejaculation. Its upward spread thereafter is due to the propagation of the colonies on the surface of the mucosa, to the collection of the retained discharge during the night, and possibly also suction action following urination. The explanation of the

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suction action referred to is, that following the extreme spasmodic contraction of the muscles capable of compressor and expulsive action, a current in the opposite direction is set in action by the creation of a vacuum until the normal condition of tonic contraction is re-established.

Extra-venereal infection, while uncommon in adults, is not unknown. In practice I have encountered five such cases in whose *bona fides* I could rely. One occurred to a medical practitioner who, having shaken hands on parting with an infected patient, proceeded to urinate before washing his hands. Two cases were infected from towels used by house-mates; another from a lavatory seat; and the fifth from a speculum in a gynæcological dispensary. A number of similar cases have been reported, and while one receives such histories with incredulity in most cases, it has to be admitted that not only are they possible, but that they actually do occur. In female children it is common for infection to spread through families and also among the inmates of institutions, so that in the case of an infected child rigorous measures for prevention should be adopted without delay.

While one attack does not confer immunity from future attacks, it is probable that in many cases it modifies the course of a later infection by decreasing the acuteness of the symptoms and developing a greater tendency to chronicity. This observation is, however, open to the criticism that such cases are really exacerbations of former uncured gonorrhœas induced by excessive indulgence.

The acuteness of the symptoms is influenced by (*a*) the virulence of the organisms; (*b*) the number of cocci gaining access to the interior of the urethra;

(c) the general resistance of the patient ; and (d) the sensitiveness of the urethral mucosa. Young and virginal subjects are specially liable to acute attacks. A soft, delicate mucosa seems to afford the most favourable medium for the activities of the gonococcus. Several men may have intercourse with the same female shortly after one another and not all be infected. Urination and washing, apart from any more active prophylactic measures, may assist an occasional escape. The fact that for several hours the infection is localised superficially in the fossa navicularis suggests the practicability of an effective prophylaxis, and this will be considered later.

*Period of incubation.*—From the time of infection until the appearance of the first symptoms a period of two to seven days elapses. In the largest percentage of cases the incubation period is three days, but in many cases when the disease is being looked for suspicion will be aroused in twenty-four to thirty-six hours, and it can then be verified by the microscope. The symptoms have in a few cases been quite well established in twenty-four hours, and on the other hand they may be delayed three weeks or even longer. Delay is due to increased resistance on the part of the patient or to a low degree of virulence on the part of the organism, or failure of the organism immediately to reach the urethra, it being located in the first instances elsewhere, e.g., in a para-urethral passage from which later the urethra becomes infected.

It has been found that many men as well as women harbour the gonococcus for long periods, years it may be, without discomfort to themselves, and some of these infected men and many of the women deny having had any of the classical symptoms of gonor-

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rhœa. These "gonococcus carriers" are a prolific source of disease, all the more dangerous because they are unconscious of the extent of the injury they are inflicting. Excitement, physical exercise, or alcoholism may in such cases give rise to the appearance of acute symptoms apart from any fresh infection.

Exacerbations incubate as a rule more quickly than new infections (one to two days). In inoculation experiments the incubation period has been two to three days.

As it is probably the toxine of the gonococcus which excites the inflammation, the delay in the appearance of the symptoms is not due merely to the time required for the propagation of colonies, but to the time required before the organisms by their degeneration and disintegration liberate endotoxine in sufficient quantity to excite a pronounced reaction.

Another explanation of the incubation period is that thirty-six to forty-eight hours expire before the gonococci are found penetrating between the cells into the tissues, and it is these organisms which stimulate nature's resisting forces expressed in the phenomena of inflammatory congestion and exudation.

### GONOCOCCUS INVASION OF THE MALE URETHRA

*Anatomical considerations.*—The average male urethra measures, when slightly stretched, about eight inches in length, but variations within the limits of six to ten inches may exist without abnormality. Except when the lumen is distended by fluids or instruments, the walls of the urethra remain in apposition. The distensibility varies from 8 millimetres at the meatus to 14 millimetres in the prostatic

portion. Figure 1 shows the natural dilatations, constrictions, and curves of the canal. The narrowest point is at the meatus, which has a diameter of 8 millimetres. This is followed by a widened area, the fossa navicularis which contracts in the penile portion to 10 millimetres. At the bulb there is again an increase to 13–15 millimetres, which at the membranous portion is suddenly reduced to 9–10 millimetres. The prostatic portion can be distended to 13–15 millimetres. Clinicians, for pronounced

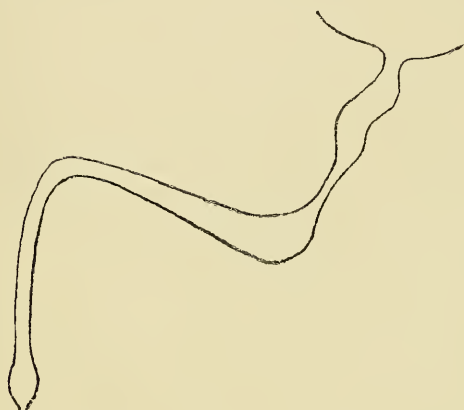


FIG. 1.

Diagrammatic representation of the curves and dilatations of the urethra.

pathological and physiological reasons, as will be shown later, divide the urethra into anterior and posterior regions, the anterior being the penile or spongy portion, and the posterior including the membranous and prostatic portions.

The anterior urethra, the spongy portion, is about six inches in length and is buried in the corpus spongiosum (*corpus cavernosum urethræ*). It begins at the meatus and ends with the bulb, beyond which it is normally shut off from the posterior urethra by

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the tonic contraction of the compressor urethræ muscle. Reference to Figure 2 will show the reason

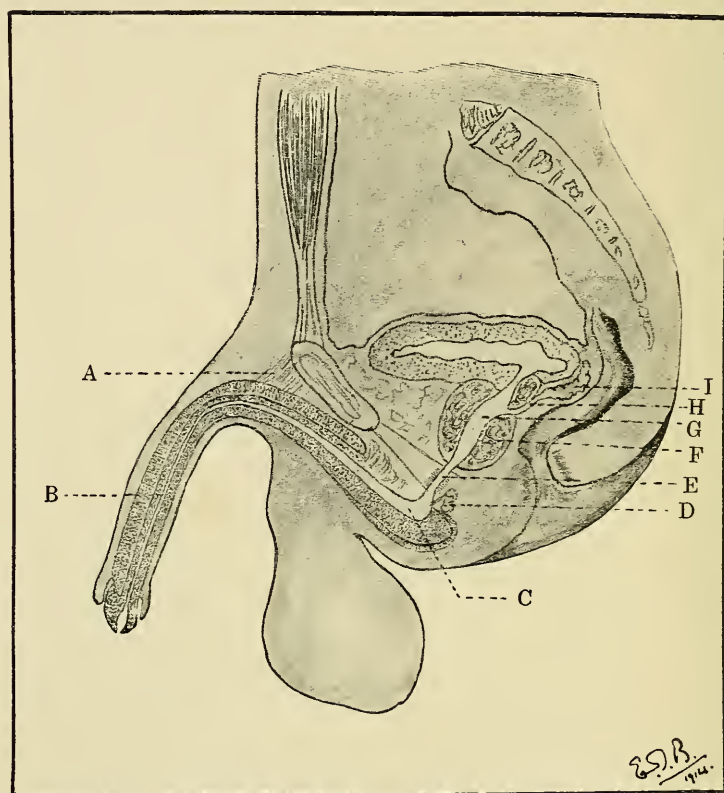


FIG. 2.

### MALE PELVIS IN MEDIAN SECTION.

- |                                  |                        |
|----------------------------------|------------------------|
| A.—Suspensory ligament of penis. | E.—Membranous urethra. |
| B.—Pendulous urethra.            | F.—Prostate gland.     |
| C.—Bulbous urethra.              | G.—Prostatic urethra.  |
| D.—Cowper's gland.               | H.—Ejaculatory duct.   |
| I.—Seminal vesicle.              |                        |

for a further subdivision of the anterior urethra into pendulous and fixed sections, the dividing line being at the suspensory ligament. The pendulous portion will drain towards the meatus, but in the perineal portion discharge will only “overflow”

towards the meatus when the retaining capacity of this section of the canal is exhausted.

Numerous minute openings pierce the lining membrane of the anterior urethra. These are the ducts of racemose mucous glands and follicles known as the glands of Littré (Figs. 3 and 4). These ducts have an oblique inclination towards the meatus, as have also the ducts of Cowper's glands, which enter the floor of the canal at the anterior end of the bulbous region. Many larger recesses, the lacunæ of Morgagni, are also found, principally along the roof and lateral walls of the urethra. The Lacuna Magna (Fig. 5) is a specially important and conspicuous recess situated on the upper surface of the fossa navicularis. All these lacunæ, like the glands of Littré, have their openings directed forward.

The mucous membrane of the anterior urethra is lined by a delicate epithelium, the superficial cells of which are long and columnar except over the first 5 to 8 millimetres in the fossa navicularis, where they are squamous and where the subjacent membrane is beset with papillæ.



FIG. 3.

Showing roof of the urethra, with bristles passed into Littré's follicles. (Taylor.)

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The posterior urethra includes the membranous and prostatic portions. The membranous portion is one-half to three-fourths of an inch long directed upwards and backwards within the layers of the triangular ligament, and is separated from the pubis



FIG. 4.

Microscopic section of one of the mucous glands or follicles of Littre opening into the lumen of the urethra : *x y*, lateral branches of main duct, with their most superficially situated acini ; *z*, continuation of main duct, with deeply seated acini ; *s s*, trabeculae of the cavernous tissue ; *w w*, tunica albuginea. (Taylor.)

by an interval of one inch. It is surrounded by a layer of unstriped muscle and also by the fibres of the compressor urethræ muscle (Fig. 6). As already mentioned, it is, with the exception of the meatus, the narrowest part of the canal. The membranous portion is the least vascular section of the urethra,

and its covering is simple columnar epithelium. Cowper's glands lie between the layers of the triangular ligament in close contact with the membranous urethra.

The prostatic portion has many important structures and connections. It is one and a quarter inches long, and its direction is nearly vertical with a slight backward curve. Although surrounded by the prostate, it is easily distensible up to a diameter of half an inch in its middle third.

A narrow median ridge, the crista urethræ, originating in the posterior part of the membranous urethra, runs backward along the floor and terminates in the colliculus seminalis or veru-

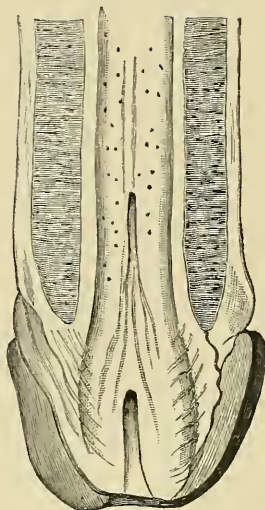


FIG. 5.

Showing the lacuna magna and a deeper valve-like pocket or crypt, and the orifices of numerous mucous glands or crypts. (Taylor.)

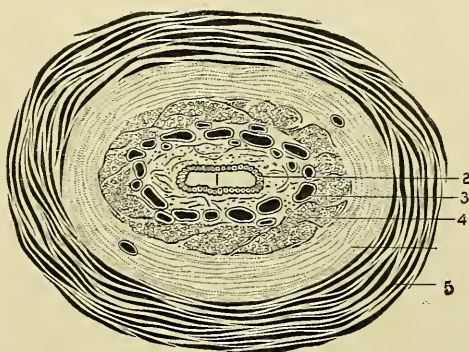


FIG. 6.

Transverse section of the membranous urethra, showing its anatomical structure: 1, lumen of canal; 2, mucous membrane with circumambient connective tissue; 3, vascular layer; 4, longitudinal muscular fibres; 5, circular muscular fibres composing the external sphincter of the urethra. (Taylor, after Testut.)

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montanum. This crest is three-quarters of an inch long and projects rather more than one-eighth of an inch at its highest point. It consists for the most part of cavernous tissue.

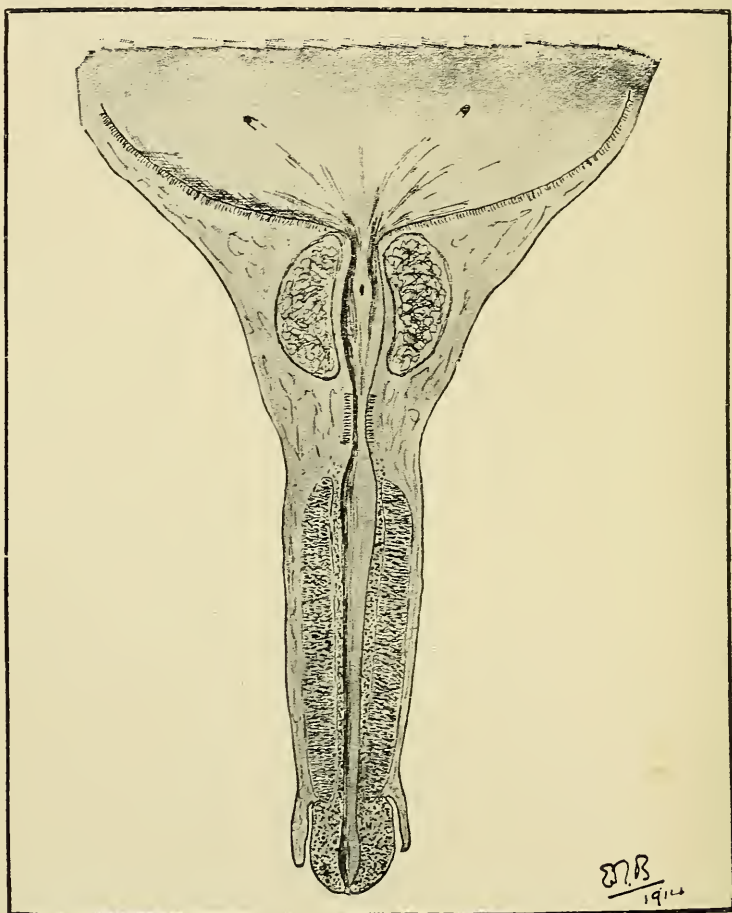


FIG. 7.

Floor of urethra and base of bladder.

In the grooves on each side of this ridge are seen the numerous openings of the prostatic ducts from which a viscid fluid oozes on pressure. On the summit of the ridge or on its anterior descending

face is placed the entrance to the sinus pocularis, a pear-shaped pouch which penetrates the prostate gland for about one-quarter of an inch or more (6 to 12 millimetres). It is the homologue of the uterus and vagina, and is lined with mucous membrane and surrounded by a circular muscular coat. The orifice in its typical form is a longitudinal cleft,



FIG. 8.

Section through the prepuce and glans.



FIG. 9.

Just behind the meatus.



FIG. 10.

Through the prepuce at base of glans.



FIG. 11.

Through prepuce and corona glandis.

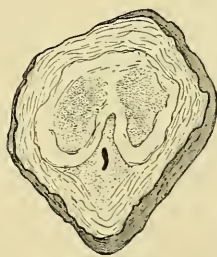


FIG. 12.

Sections just behind the corona glandis, spongy and cavernous bodies well shown. (Taylor.)



FIG. 13.

2-3 millimetres long, and on or near its lips are the openings of the common seminal or ejaculatory ducts.

The mucous membrane of the prostatic portion of the urethra is covered by a laminated epithelium like that of the bladder. The sinus pocularis is lined by a columnar, and according to some authorities, ciliated epithelium pierced by numbers of small

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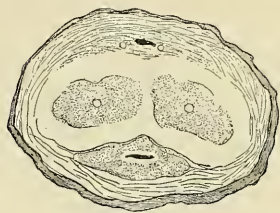


FIG. 14.

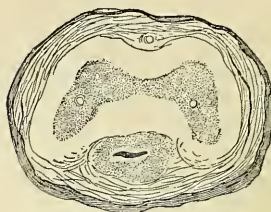


FIG. 15.

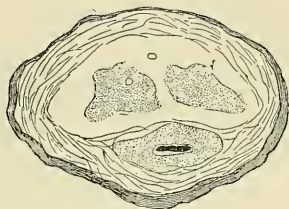


FIG. 16.

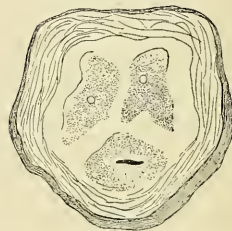


FIG. 17.



FIG. 18.

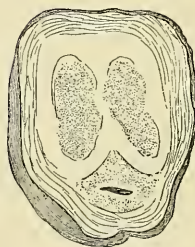


FIG. 19.

Figs. 14 to 19 show sections from before backward through the penile urethra. The pectiniform septum is complete except Fig. 15, where corpora cavernosa are continuous with one another. (Taylor.)

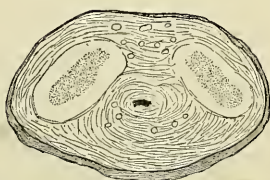


FIG. 20.

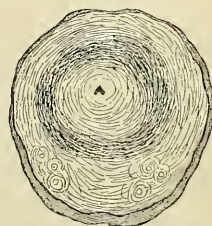


FIG. 21.

Through bulbomembranous junction, urethra surrounded by some anterior fibres of the compressor.

Through apex of prostate. (Taylor.)

convoluted glands. In the posterior urethra the erectile tissue is scanty, while the muscular coat is well developed.

*The striated and unstriated musculature of the urethra.*—Close to the vesical insertion of the urethra and under cover of the prostate there is a circular bundle of unstripped muscular fibres mixed with elastic fibres,

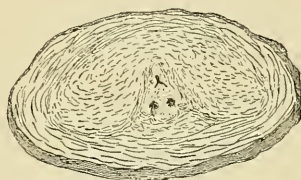


FIG. 22.

Showing the position of the ejaculatory ducts in the middle of the prostate under the verumontanum just before they turn upward and end in the prostatic urethra. The capsule of the prostate is well shown. (Taylor.)

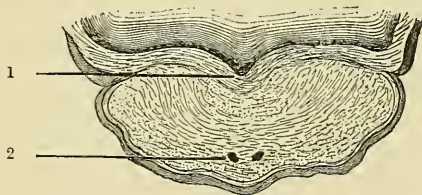


FIG. 23.

Showing the position of the ejaculatory ducts in the lower part of the prostate and behind the urethra : 1, vesical orifice of the urethra ; 2, ejaculatory ducts. (Taylor.)

to which the name of internal prostatic or vesical sphincter has been given. Towards the apex of the prostate there is another grouping of unstripped fibres which, together with some striped fibres of the compressor urethræ, form the external prostatic sphincter. The membranous portion of the urethra is surrounded by both striated and plain muscle fibres, the former belonging to the compressor urethræ muscle.

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There is thus a triple arrangement of sphincters in the posterior urethra, and considerable difference of opinion has been expressed as to their relative strength and their functions. Finger enunciated the theory that the internal sphincter close to the bladder was only of sufficient power to retain a small quantity of urine in the bladder, and that as the urine accumulated the posterior urethra became merged into the bladder, forming a funnel-shaped "neck." He attributed real power of retention to the combined action of the musculature of the membranous portion of the urethra. This view is supported by some experimental and clinical evidence which merits consideration. Thus it is asserted that the urethra is shortened when the bladder is full, and that a catheter at a depth of 16-19 centimetres will tap the urine, as against a passage of 18-21 centimetres required to reach the interior of the bladder. This difference of 2 centimetres indicates, according to Finger, that to this extent the prostatic urethra has been merged into the cavity of the bladder. A possible explanation of this shortening of the posterior urethra, however, may be found in the suggestion that the longitudinal unstriated muscle fibres contract when the bladder is distended for the purpose of re-enforcing and combining the action of all the circular fibres to ensure complete control of the urine. The shortening could also be contributed to by the downward pressure of the heavy bladder.

Finger quotes some experiments conducted by Born, who injected plaster of Paris into the bladders of recently killed animals, and found that when a small quantity was used the plaster cast had an ovoid form and was sharply defined from the urethra by the action of the internal sphincter. When a quantity

sufficient to distend the bladder was inserted the cast was pear-shaped, owing to the absorption of the prostatic urethra into the bladder to form one vesicoprostatic chamber, the prostatic portion forming, of course, the apex of the cone.

Leedham-Green successfully controverts the results of these experiments ("British Medical Journal," August, 1906), which he discounts as having been conducted on dead animals in conditions so unlike those obtaining in man during life as to be valueless. When, on the other hand, he injected a suspension of bismuth into the bladders of certain men and youths, he found that the radiograph in each case, whether the bladder had been fully distended or not, was oval and not pear-shaped, and that the urethra was sharply cut off from the bladder without a suggestion of bladder neck.

Comparison with the anatomical arrangement in the female, in my opinion, finally disposes of this widely-taught theory.

Another point of much importance concerns the strength and utility of the sphincter action of the muscles surrounding the membranous urethra, and said to shut off the posterior urethra from the anterior. Extreme views have been advocated on both sides, and each contains some elements of truth. I think that it is advisable, however, to emphasise the danger of placing too much reliance on the security of this barrier. It is probable that in most cases the contraction is sufficient to prevent the immediate ingress of injected fluids unless considerable pressure is applied, but continued pressure will overcome the resistance in all cases.

The injection of an irritating fluid into an inflamed urethra excites marked contraction and even spasm,

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especially in patients of a nervous temperament. On the other hand, the use of bland fluids at a suitable temperature helps to allay the tendency to contraction, and when employing local anæsthetics the risk of abolishing this reflex should not be overlooked. There is considerable individual variation as regards the resistance offered. In washing out the urethra according to Janet's method, the anterior urethra is first irrigated at a low pressure, and thereafter the pressure is increased until the fluid enters the posterior urethra and bladder. The voluntary efforts of the patient to relax the compressor urethræ are an aid in most cases. That in practically all cases this procedure is possible proves the fallibility of the sphincter as a guard against the invasion of the posterior urethra by an injection in the hands of a strenuous patient. Patients are frequently told to fill the urethra to its fullest capacity, to retain the solution for ten to fifteen minutes, and at the same time to massage the penis with a view to ingratiating the injection into all the crevices. In many, if not all, of such cases, a portion of the injection will find its way into the posterior urethra with unfortunate results. In the use of soluble bougies there is also a distinct risk of the posterior urethra being entered, especially if one is inserted at bedtime. Sufficient has meantime been said to show that care has to be exercised in applying local treatment which it is desired to limit to the anterior urethra. The capacity of the anterior urethra in the average man is from 8-14 cubic centimetres.

The compressor urethræ being composed of striated fibres is a voluntary muscle, but its action is mainly a reflex one, and it is not sufficiently under the control of the will to ensure a successful closure on

demand. Its tonic contraction, however, will aid the unstriped circular fibres in occluding the membranous urethra.

Whether secretions can escape from the posterior urethra through this sphincter is another debated point. Finger, Scholtz, and others maintained that the external sphincter is an absolute check to the passage of secretions, blood, etc., from the posterior urethra so as to appear as an external discharge. They hold, on the contrary, that such discharge always passes backward into the bladder. It is generally admitted that this is in accord with most clinical observations. The probable explanation is that the combined strength of the external sphincter and the compressor urethræ is greater than that of the internal sphincter, and that fluids in the posterior urethra seeking the direction of least resistance find their way into the bladder.

#### THE DISTRIBUTION OF THE GONOCOCCUS IN THE MALE URETHRA

Gonococcal growth is spread throughout the urethra by the action of several agencies. In the first place, direct colony extension by subdivision of the organism, as in a culture tube, is in constant progress. But were this the only method of propagation, several weeks must elapse ere the bulb and the entrance to the posterior urethra could be reached. Rapid extension is due to the deposition of new colonies from the collection of infected pus which gathers in the urethra when closure of the meatus by dried secretion or dressings delays or prevents the escape of the discharge. Another factor in the upward extension doubtless is the suction action already

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referred to which follows seminal emission or urination. A consideration of these points suggests the necessity for free and uninterrupted draining day and night, the avoidance of any arrangement of suspensories or dressings which would interfere with the pendulous position of the penis, and possibly the use of some form of slight constricting band above the area of infection. Further consideration of these points will arise again in connection with treatment.

Extension to the posterior urethra is delayed and in many cases prevented by the tonic contraction of the circular muscular fibres, striped and unstriped, which surround the membranous urethra, so that in about 30 per cent of untreated cases, and in a much larger percentage of suitably treated cases, the gonorrhœa is limited to the anterior urethra, not only in the initial stages, but throughout its whole course.

This closure of the first portion of the posterior urethra is, as has already been pointed out, not sufficient to prevent the backward passage of gonococci whether conveyed by fluids, instruments, or growth of colonies, but the membranous portion presents in normal conditions a much less favourable medium for the successful deposition and growth of colonies than the other parts of the urethral canal. When posterior urethritis appears, it usually begins in the prostatic portion, and invasion of the membranous mucosa is secondary to that of the prostatic. All the conditions helpful to the activity of the gonococcus prevail in the prostatic area, but many of them are wanting in the membranous. Thus the normal contracted condition of the canal in preventing the collection of discharge with its resulting irritation is a most important factor in the comparative

immunity of the membranous mucosa to invasion from below. When the prostatic urethra is already involved, this freedom from gonotoxine irritation does not obtain to the same extent, for although the discharge in the posterior urethritis escapes backward into the bladder, it only does so when the prostatic portion is dilated by the pressure of the collecting pus, and a force sufficient to overcome the internal prostatic sphincter of the bladder accrues therefrom. During the accumulation of this pus there will be an ever-increasing and spreading irritation of the upper region of the membranous urethra, and after every micturition the mucous membrane will be left moist with a gonotoxic urine.

In no case, however, does the membranous portion suffer from such acute or prolonged infections as the other parts of the urethra. The nature of its epithelium and its comparative freedom from glands and culs-de-sac is largely responsible for this resisting power.

On the other hand, the prostatic urethra is susceptible to acute inflammations, and its numerous glands and ducts form happy hunting grounds for the future life of the gonococcus.

#### ACUTE ANTERIOR GONOCOCCAL URETHRITIS

Acute anterior gonorrhœal urethritis in the male is most suitably described as developing in three stages, and this is quite in accord with the clinical course of the disease, although the stages are by no means sharply defined, but merge imperceptibly from one to the other. These stages are (*a*) the mucous, initial, or prodromal stage ; (*b*) the purulent or middle stage ; (*c*) the resolving or terminal stage.

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There are also three principal types. In the first, the disease runs a mild course with the symptoms but slightly marked; the second is the common acute form; the third includes those cases in which the inflammation is hyperacute and the symptoms correspondingly violent.

In the first place, a description of an ordinary acute gonorrhœa in its three stages will be submitted, and following that the appearances shown by the mild and severe types will be considered.

*The mucous stage.*—When a man knows that he has subjected himself to the risk of infection and is anxious as to the result, he will be keenly sensitive to the slightest feeling of irritation. The first evidence he will have of the onset of the disease will be a slight sensation of heat and tingling within the meatus, most marked whilst urinating. In a short time it will be possible to express from the urethra a small quantity of thin glairy mucus. If the meatus be examined at this period, a commencing redness of the mucous membrane will be noticed.

The subjective symptoms may be so trifling as to be entirely overlooked by the patient, but if he allows the slight inflammatory reaction to excite him to further excesses, the more acute symptoms will be precipitated.

Microscopic examination of the secretion in this stage shows, in addition to mucus and epithelial cells, a variable but usually small number of polynuclear leucocytes and numerous, mostly extracellular, gonococci, many of which will be found adhering to epithelial cells. The appearances shown by the smear depend largely on the manner in which it has been obtained, i.e., by platinum loop, spoon, or swab.

The swab is the most satisfactory method in this stage, as it is also in chronic conditions. Gonococci are lifted from the epithelial surface and appear in the smear in greater numbers, so simplifying the diagnosis. A small quantity of sterile wool is wrapped round a thin ball-pointed probe, and after the meatus has been cleansed, the probe is carefully inserted for about an inch and gently rotated. On transferring the material so obtained to the slide, care should be taken to spread the smear with uniform thinness. Staining by Gram's method is essential for differentiating the gonococcus, but for examination of the cells other methods are applicable.

The purulent stage is usually established by the second or third day. The character of the discharge changes from mucous to white, milky muco-pus. This soon becomes thicker and creamy yellow, and by the beginning of the second week a greenish tinge, due to admixture with a minute quantity of blood, is usually evident in the discharge. It is copious in quantity and constant in its flow, but is subject to some increase at night. Examination of the urine by Thompson's two-glass method may demonstrate even more clearly than a scrutiny of the meatus and clothing the amount of pus which is being excreted.

Ectropion is produced by eversion of the "angry" red mucosa at the meatus. The irritation of the glans causes it to appear red, turgid, and swollen. The inflammation spreads along the frœnum to the prepuce, and the resulting œdema may give rise to either phimosis or paraphimosis, according to the length and position of the prepuce. The whole penis becomes swollen, hot, and tender. Lymphatic vessels may appear in the skin as red streaks and the inguinal glands may be enlarged and painful, but suppuration

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does not usually supervene. The urine is discharged in a small stream, partly on account of the engorged and swollen condition of the mucous membrane, and partly from reflex as well as conscious retardation in the attempt to minimise the pain caused by the passage of the acid urine over the inflamed surface. The scalding pain experienced on passing urine, “ardor urinæ,” is the most distressing of the subjective symptoms. During the height of the inflammation it is so severe that the patient dreads the necessity for micturition, and the bladder is emptied as slowly as possible to avoid distension of the exquisitely tender urethra. Pain at first is limited to the times of urination and a few succeeding minutes, but later it is more or less continuous. It may be felt along the whole anterior urethra, but it is usually most marked at the fossa-navicularis and at the bulb. It is increased by pressure on the bulb, e.g., during exertion and during sitting. Pain in the back is also common.

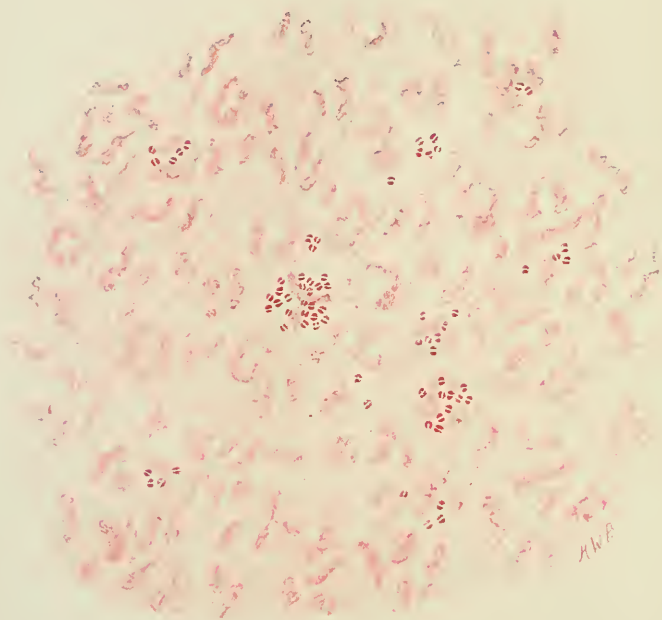
Another troublesome symptom is the occurrence of painful erections. These are most frequent at night, and cause great discomfort both on account of the accompanying pain and the interruption of sleep. The pain is due to the tension on the urethra and its surrounding area of corpus spongiosum involved in the inflammatory process.

In spite of the severity of the local symptoms, the constitutional symptoms are comparatively trifling. Apart from pallor, decreased appetite, and feeling of *malaise*, there is little evidence of any disturbance of the ordinary health.

The inflammation reaches its height usually by the end of the second week, and during the third week the symptoms are maintained with but little remission



## PLATE VII.



Film of pus showing Gonococci (stained Gram and counterstained 1 in 10 Carbol-Fuchsin).

from the acute level, but thereafter in favourable cases the resolving or terminal stage begins.

*Microscopic appearance of the discharge in the purulent stage.*—A drop of the discharge may be obtained from the meatus after external cleansing by direct contact with the slide. The end of the slide should be chosen for this purpose, and the pus is spread by drawing the edge of another slide held at an oblique angle along the whole length of the smear slide as in making a blood preparation. This gives an equal and thin distribution of the material.

With the platinum loop it is difficult to spread the pus with a sufficiently thin and even smear. The cotton-wool swab is more satisfactory, but with its use the number of extracellular gonococci is increased, while intracellular gonococci are diminished.

On examination with an oil immersion lens great numbers of polynuclear leucocytes are seen, many of them containing gonococci in pairs or groups. It is remarkable how little deleterious effect seems to be produced on the leucocytes by the ingested gonococci; their staining properties are unimpaired, no signs of degeneration being evident. The same is true regarding the action of the leucocytes on the gonococci; their activity is not interfered with by absorption into the leucocytes, in fact they are said to multiply in this position. Some cells are crammed with organisms, yet both the cell structures and the cocci stain beautifully.

Discharge which has been retained in the urethra for some little time shows a larger number of intracellular gonococci than pus expressed after cleansing the urethra.

Epithelial cells are few or absent. The few that may be present are not like the large lamellar cells

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found in the mucous stage, but smaller, oval, transitional forms. A varying number of eosinophile cells have been shown to be present. These are scanty in the first two weeks, but increase later, especially if the posterior urethra become involved. Mast cells and mononuclear lymphocytes are, in addition, found in the late phase of this stage.

That phagocytosis occurs is evident, as the gonococcus itself has no power of movement, and therefore no power to penetrate the leucocyte. In fact, an active phagocytosis can be seen in progress on making an artificial mixture of fresh human pus, serum bullion, and gonococci. Phagocytosis is most active in the lumen of the urethra. That it also occurs to a small extent in the submucous tissue can be proved by examining stained sections.

*The resolving, declining, or terminal stage* is the period during which the inflammatory symptoms subside. In a case which is running a satisfactory course, the terminal stage may be expected to assert itself in the fourth week, and to terminate in the disappearance of all subjective symptoms after a period of retrogression lasting two to three weeks. There is, however, no dividing line between the purulent and the declining stages. They merge imperceptibly into one another over an intermediary period of several days. The discharge gradually decreases in quantity and purulence, until it becomes scanty and muco-purulent, and finally only appears as shreds in the first volume of urine and a trace of hypersecretion evident only in the morning. Ultimately the secretion becomes normal, with no evidence whatever of any excess.

All other symptoms are, before the onset of the terminal stage, much reduced in severity, and the

patient in the last stage suffers little inconvenience, apart from that necessarily associated with the continuance of any discharge. There is now no distress on micturition, and erections, although annoying and excessive, are not painful and the sleep is not disturbed.

At any time in the course of the declining stage a relapse may occur. A reason for the recrudescence may be elicited from the patient in an admission of a departure from the path of rectitude either as regards venery or alcohol ; or it may be attributable to excess in eating or to physical exertion.

*Microscopic appearance of the discharge in the terminal stage.*—Mucus makes its reappearance, and the purulent characteristics become proportionately lessened. Epithelial cells, some of which contain keratin granules, appear in increasing numbers. Gonococci are more sparsely distributed and finally are difficult to find in the discharge.

In the foregoing account of the moderate type of gonococcal inflammation, it is understood that the description applies only to untreated and uncomplicated cases. The modifying influence of treatment and the effects of complications and exacerbations will be considered in their respective chapters.

#### THE SUBACUTE OR MILD TYPE OF GONOCOCCAL URETHRITIS

In this class of case the symptoms of the mucous stage may continue with but little evidence of a purulent phase, either as regards the discharge or other symptoms of acute inflammation. Such cases are difficult to distinguish from those of a “simple

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urethritis," and in fact the diagnosis is determined only by demonstrating the presence of the gonococcus in smears and cultures taken from the urethra. The possibility of the organism being the micrococcus catarrhalis must be kept in view.

All urethras are not equally sensitive to the products of gonococcal activity. Some individuals may harbour gonococci without symptoms of inflammation being present. As a rule, when a positive result follows the search for the gonococcus, whether undertaken for medico-legal or other purposes, a history of a previous acute attack of gonorrhœa will be obtained, and the presence of the gonococcus is due to the chronic infection of a para-urethral passage, gland, or cul-de-sac in the anterior urethra or of some structure in the posterior urethra. But occasionally a case will be encountered where no history of previous gonorrhœa can be obtained, and where there is no evidence of chronic inflammation, yet gonococci are present in the urethra. If the patient is a married man his wife may be found to be infected, and this may be the source of repeated reinoculation with gonococci. Thus his infectivity, which otherwise would probably be determinate, is indefinitely maintained. How long the gonococcus would survive, without reimplantation, in the urethra of a non-susceptible carrier it is impossible to say. One cannot draw accurate conclusions from the small number of cases and experiments at present available for consideration.

The influence which prevents the inflammatory reaction to the gonococcus may have either a local or a constitutional origin. Thus it may be due to the resistant properties of the urethral epithelium, or there may be in the blood a substance in the nature

of an antibody which inhibits the fertility of the organism. The former is the more probable explanation of these cases. Variation in the virulence of different strains of gonococci plays no rôle in this connection.

All gradations from the case of a non-susceptible carrier to a case of gonorrhœa with the usual symptoms, only in lessened degree as regards acuteness and duration, may be classified as belonging to the mild type of gonorrhœal infection.

#### THE HYPERACUTE TYPE OF ANTERIOR GONOCOCCAL URETHRITIS AND ITS LOCAL COMPLICATIONS

In from 10 to 20 per cent of all cases, owing to a general or local susceptibility of the patient, or to injudicious habits or treatment, the inflammatory reaction is exceptionally acute, and the symptoms show a corresponding excess in their severity. In such cases, resolution is delayed and complications are frequent. On account of the severity of the suffering and continued loss of sleep, the general health is markedly involved. All the symptoms already enumerated are exaggerated; ectropion of the urethral mucous membrane is pronounced; the discharge is distinctly greenish or even hæmorrhagic, and œdema spreads from the prepuce to the penis, which is considerably swollen and very tender. The passage of urine is attended with agonising pain; the stream is thready, corkscrew, forked, and interrupted, or discharged in drops. Complete retention of urine is rare, except in cases where a stricture has previously existed. Pain is not limited to urination, but is continuous and radiates to the groins, testicles, thighs, and back. When the

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prepuce is long, the inflammation contracts its orifice, retraction becomes impossible, and thus phimosis is produced. This interferes with the free escape of the discharge, and numerous pyogenic organisms other than the gonococcus make their appearance and excite inflammation of the skin of the glans and coronal sulcus (balanitis and posthitis) with erosions, fissures, and sometimes sinus formation. The impossibility of maintaining cleanliness predisposes to the growth of venereal warts (condylomata acuminata). This state of affairs complicates the diagnosis and renders treatment difficult.

A short or retracted prepuce becoming inflamed and œdematous causes paraphimosis, with consequent compression of the urethra, retention of the discharge, and upward spread of the disease. Difficulty or even stoppage of urination may result, and in extreme cases there may be sloughing of the glans.

The lymphatics are invaded by the gonococcus, and appear as red streaks encircling the penis to join the dorsal lymphatic vessel, which is itself inflamed and prominent.

Occasionally there is found in the course of the dorsal lymphatic vessel near the root of the penis, a small area of circumscribed infiltration, which probably arises from a minute lymphatic gland in this position. This is called a "bubonulus." It may soften and discharge through the skin. If incised it will be found to contain a mixture of blood and pus, from which gonococci may be cultivated.

The inguinal glands are enlarged and painful, and a suppurating bubo may result. Lymphangitis and lymphadenitis may be due only to the action of the gonococcus or its toxines, but frequently other

organisms are secondarily concerned in the inflammatory process.

Chordee is produced by involvement in whole or part of the tissues of the corpus spongiosum in the inflammatory process. The meshes become infiltrated with plastic lymph which agglutinates the walls of the spaces and prevents the tissue from distending when called upon during erection. The corpora cavernosa are not involved in this way, and when they become engorged with blood the inelastic but exquisitely sensitive spongy body and urethra cannot stretch as required, and the shortening of this side of the penis produces a marked curving of the organ forward and downward. A patient so affected will rise from bed and by the application of cold water attempt to reduce the erection, but immediately on returning to the warm bed, the state of matters will be as bad as ever. Maddened with the torture of this condition, violent attempts to "break the chordee" may be made. These are likely to result in rupture of the urethra and considerable hæmorrhage, with traumatic stricture to follow. Fortunately, although painful erections are present in practically all cases, chordee is a comparatively rare complication.

The formation of a diphtheroid membrane on the urethral mucosa has, in a few cases, been observed. This condition has to be distinguished from the membranous urethritis sometimes noticed in chronic conditions when portions of urethral casts are shed which consist entirely of layers of epithelium. Epithelial casts are sometimes found also in the late period of the acute stage when strong silver or other irritating injections have been used.

Minute firm bodies, varying in size from a pinhead to a hay seed, may be felt along the course of the

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urethra on the under surface of the penis. These are inflamed glands and lacunæ, and their presence indicates that the gonococci have penetrated deeply into the glands and is thus of unfavourable import as regards prognosis.

Para-urethral passages are now known to be of fairly frequent occurrence. When present they are likely to become infected, in which case they constitute a tedious complication unless excision of the whole passage or destruction by electrolysis is feasible. These offshoots of the urethra usually terminate blindly after a short course in the corpus spongiosum, but great variety as regards length and course occurs. Thus they may penetrate into the corpus cavernosum, and in rare cases they may open externally either close to the lips of the meatus or near the frænum, forming an accessory urethra. More commonly, passages which communicate with the exterior have no connection with the urethra, but after a longer or shorter course terminate blindly or in another external opening. Such passages have been found on the under surface of the penis running parallel with the dorsal lymphatic vessel. Two cases have been reported where the situation was on the lateral walls of the penis. It is possible for such passages as have only an external skin opening to become infected by the gonococcus without an accompanying urethritis, and authentic instances of this have undoubtedly occurred.

When a para-urethral diverticulum emanating from the urethra becomes converted into a cystic or pseudo-abscess it can be felt as a firm, tensely elastic body varying in size from a rice grain to a cherry-stone in the substance of the penis. They usually rupture into the urethra. The accessory urethras

when acutely inflamed are seen as projecting cords, and the overlying skin is usually reddened. The importance of these para-urethral canals is very great, in that they tend to indefinitely prolong the infection.

Cowper's glands, the ducts of which open into the bulbous urethra, may become implicated during the course of an acute anterior urethritis when the disease reaches the mucous membrane of the bulb. Gonococcal growth may spread along a duct, and should the walls become adherent during the inflammation or the lumen occluded by the swelling of its membrane, the result would be a retention cyst, the contents of which would become purulent, forming a pseudo-abscess. This condition is evidenced by pain and swelling in the perineum on one side of the middle line owing to the appearance of a tender node the size of a cherry or larger. The inflammation tends to spread forwards towards the bulb, the direction in which the duct runs. Sitting, walking, urination, and defecation are accompanied by an increase in the pain. Sometimes both glands are affected.

The subjective symptoms of inflammation of Cowper's glands are similar to acute inflammation of the bulb, but palpation of the inflamed gland in its anatomical position in the perineum makes the differential diagnosis a matter of little difficulty. The gland can be grasped between the forefinger and the thumb, the former being in the rectum and the latter on the perineum in front of the anus. Cowperitis is not in my experience a rare complication. If diagnosed soon after its onset the adoption of antiphlogistic measures will in many cases cause subsidence of the inflammation; but if it tends to burst, it should at once be incised in the perineum,

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otherwise it may rupture both into the urethra and externally, causing a troublesome fistula. Chronic inflammation of a Cowper's gland is suggestive of an underlying tubercular condition. An acute Cowperitis is said to be a not infrequent complication of pneumonia.

The occurrence of stricture formation during the course of an acute anterior urethritis is rare. Stricture is associated as a rule with chronic gonorrhœa, but it may exist in acute conditions as a result of para-urethral infiltration or of traumatism of the urethra from injudicious treatment.

Gonococcus metastasis is quite uncommon during an uncomplicated urethritis limited to the anterior urethra, and is practically always associated with posterior gonorrhœa.

### ACUTE POSTERIOR GONOCOCCAL URETHRITIS

It has already been stated that in about 70 per cent of untreated or insufficiently treated gonorrhœas, infection of the posterior portion of the urethra follows in the natural course of events. Finger asserts that the extension of the disease is to be expected in the third week, by which time the colonies of gonococci have extended by continuity of growth along the wall of the urethra to the bulb and the entrance to the posterior urethra. It is now known that fresh isolated colonies are started by deposition of cocci from the retained discharge, and that in many cases the bulb contributes to the gonorrhœa as early as the first week.

As soon as infection reaches beyond the pendulous portion of the anterior urethra, the discharge will, on account of the slightly downward inclination of the

perineal portion of the canal as it passes backward to the bulb, tend to gravitate posteriorly, thus inevitably infecting the whole remaining part of the anterior urethra. Erections doubtless precipitate the backward movement of infective material, and this probably explains much of their harmful effect on the course of the disease.

Heissler, observing fifty cases, noted the onset of posterior urethritis during the first week following infection in 20 per cent of his cases, during the second week in 34 per cent, during the third week in 14 per cent, and during the fourth week in 20 per cent of cases.

The involvement of the posterior urethra introduces the serious element into the case. The course of the disease is prolonged, in a considerable proportion of cases indefinitely, the liability to complications is greatly increased, and local treatment is rendered more difficult. This is due to the many passages opening into this division of the urethra, some of which may act as lurking-places for the organism, while others communicate with important structures susceptible to gonococcal inflammation.

That nature can in the smaller percentage of cases successfully oppose the backward spread of the disease is due to two obstacles to the extension of the gonococcal growth. These are (*a*) the closure of the membranous urethra by the tonic contraction of its circular muscle fibres, striped and unstriped, and (*b*) the relative insusceptibility of the mucosa of the membranous urethra to the action of the gonococcus. The effectiveness of these deterrent factors varies in different individuals. Not uncommonly the epithelium on the lower wall of the membranous urethra

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is of the columnar type and susceptible to gonorrhœal inflammation. The onset of posterior urethritis may be determined either during the process of an acute or chronic anterior urethritis or following an exacerbation by the occurrence of erections, by indiscretions in food or drink, by excessive exercise, and by unsuitable treatment. The subjective symptoms of posterior urethritis are in about one-half of all cases slight in character, and may not attract special notice at the time. Apart from some increase in the discharge and in the frequency of micturition, the patient may be unconscious of any untoward development. The inflammation reaches its height in two or three days, and the most serious consequences in these mild cases is the prolongation of the disease which inevitably ensues. In the other 50 per cent of cases the onset is accompanied by severely acute symptoms. This difference in the reaction of the posterior urethra to gonococcal invasion is in accord with what is found in any form of irritation of the pars posterior. It has been proved experimentally that one urethra posterior is very sensitive to irritation, while in another inflammation is not easily excited. In employing Guyon's method of treating posterior urethral disease by instillation of small quantities of strong silver solutions the same diverse results are seen, some cases developing tenderness and pain, and others suffering little discomfort. The difference in the acuteness of the symptoms displayed by these varieties of posterior urethritis is therefore explained by variations in the sensitiveness of the normal mucosa.

In the acute type, the most urgent symptom is the excessive frequency in micturition, often amounting to strangury. The patient is impelled to urinate

every hour or even less. In the worst cases, urine is passed in small quantities every few minutes. The attempt is accompanied by great pain and considerable straining, and the emptying of the bladder is not followed by relief from the pressure. A characteristic symptom is the discharge of a few drops of blood at the end of micturition. This is known as "terminal hæmaturia." The hæmorrhage does not come from the bladder. This has been proved by the introduction of a catheter. It is probably expressed from the blood-vessels of the prostatic urethra whose walls have been injuriously affected by the inflammatory process and are unable to cope with the sudden and frequent alterations in tension. Another possible source is the sinus pocularis, in which case the hæmorrhage would be analogous to metrorrhagia. Sometimes a worm-like clot is expelled with the first portion of urine.

The discharge may not be obviously increased as it is washed away by the frequent acts of urination, but if the urine is collected and examined it will be seen to contain a considerable quantity of pus. Another reason for there being no apparent increase in the discharge is that during any considerable interval of urinary retention the discharge finds its way backward into the bladder rather than forward into the anterior urethra, from which it is shut off by the external sphincter.

Erections are not so markedly a symptom of posterior urethritis as of anterior, but painful and bloodstained emissions are occasionally a source of distress to the patient. The temperature rises, especially at night, to from 100° to 104° F. Pain in the perineum, thighs, and back is a cause of much complaint. The night's rest is greatly disturbed, and the patient's condition is one of severe illness.

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Albuminuria in excess of what can be accounted for by the presence of pus in the urine is present in 10 per cent to 15 per cent of cases of acute posterior urethritis.

In only a very small proportion of cases is this albuminuria associated with extension of the disease to the kidney. It is always accompanied by urinary tenesmus, and ceases when the urinary pressure is relieved, e.g., by atropine. It may therefore be accounted for by the occurrence of a reversed peristaltic action passing up the ureter to the pelvis of the kidney and interfering with its function.

The diagnosis of posterior urethritis is rendered certain by an examination of the urine in separate portions. Sir Henry Thompson's original method (1868) was to use two glasses as receptacles for the first and second halves of the urine. The first urine washes out the whole urethra, and will contain such pus as may have been lying in the canal or adhering to its walls. The second glass contains the contents of the bladder unmixed with discharge from the anterior urethra. As the discharge of posterior urethritis regurgitates into the bladder, pus in the second portion of the urine in the Thompson test indicates the presence of a posterior urethritis. In very severe cases, frequently passing dribbles of urine, a quantity sufficient for this test may not be obtainable, but in such cases there is already little doubt about the diagnosis. A rectal examination will show the presence of tenderness of the prostatic portion and decide the question. In less acute cases it is advisable to divide the urine into three volumes. The first glass should contain not more than two-thirds of the total quantity, the second one-third, and the third glass the last drops of the urine. Before using the third

glass for the final drops of urine the prostate may be gently massaged if thought advisable. In antero-posterior urethritis, the first glass will show pus from the bladder and the entire urethra. The second will still show pus, but in less quantity, as it contains the contents of the bladder only. The third may show greater concentration, as it may contain pus which has gravitated into a pocket of the bladder at a level below the vesical opening of the urethra, and in addition such pus as may be expressed during the last straining efforts of urination from the ducts in the prostatic urethra.

When the discharge is scanty, greater accuracy can be obtained by a preliminary washing out of the anterior urethra to remove whatever pus it contains. This is best carried out by means of a large glass syringe, with which the anterior urethra is carefully injected several times, until, in fact, the washings return quite clear. The pus-contaminated water is collected in glass one, glass two is used as a control glass to contain several further clear washings. Into glasses three, four, and five the patient now passes urine as in the three-glass test. If pus is present in the urine it must be derived from the posterior urethra, and indicates an active posterior urethritis. This test should preferably be performed in the morning before the patient has passed urine, and in any case a three-hours' interval is necessary to allow a sufficient quantity both of urine and discharge to collect. The patient should stand while the urethra is being washed out by the surgeon, and sterile water or a mildly antiseptic solution, e.g., boric acid, should be used. An irrigating apparatus fitted with a small conical glass nozzle instead of a syringe may be used. The reservoir should contain a pint of fluid. It

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must not be raised beyond a height of two and a half feet above the level of the urethra, otherwise the irrigating solution might penetrate into the posterior urethra. The urethral nozzle is inserted at the lower angle of the meatus, while the upper angle is controlled by the thumb and forefinger of the operator. Closing of the upper part of the meatus enables the anterior urethra to be distended with the solution, and then relaxing the fingers enables the fluid to escape into a glass receiver without removing the nozzle. If the shape of the meatus does not lend itself to this procedure, the urethra is alternately filled and emptied by closure of the meatus with the canula and its withdrawal as soon as the urethra is gently distended. This lavage of the canal is continued until the washings return absolutely clear, showing that the anterior urethra is completely free from pus.

In washing out the anterior urethra the canal may be compressed at any selected point and cleansed in sections if it is thought desirable to investigate the condition of the separate areas.

It need hardly be mentioned that the possibility of the cloudiness of the urine not being due to pus must be eliminated. The possible sources of error are phosphates, urates, mucus, and bacteria. Urates will dissolve on heating; phosphates on addition of acetic acid; bacteriuria must be diagnosed by the microscope; and the addition of a solution of caustic potash or soda will convert pus into a ropy gelatinous mass.

The complications and sequelæ liable to follow in the train of a posterior urethritis will be indicated by a reference to the anatomy of the posterior urethra. Extension of the inflammation along the ducts of the prostate gland produces the different

types of prostatitis. The sinus pocularis is frequently attacked, and it may be a source of long-continued trouble. Reversed peristaltic action carries the infection along the ejaculatory ducts to the vesiculæ seminales which are susceptible to gonococcal inflammation, and also along the vas deferens to the epididymis, producing epididymitis. These complications are so important as to require detailed consideration in following chapters.

## CHAPTER V

### TREATMENT OF ACUTE GONOCOCCAL URETHRITIS

THE objective of all treatment is the eradication of the gonococcus and the repair of the damaged tissues. A direct attack on the organism is rendered difficult, owing, in the first place, to the sensitiveness of the urethral mucous membrane, especially when it is in an inflamed condition; and secondly, on account of the early penetration of the gonococcus into the interstices of the epithelial and subepithelial layers. The therapeutic agent adopted should therefore be one which, in addition to being lethal to the gonococcus, possesses a maximum of penetrating power and a minimum of irritating property.

The progress of the disease can be influenced by efforts to stimulate the patient's immunising mechanism, and also by attempts to render the tissues of the host unsuitable as a medium for the growth of the gonococcus. To be able to cure gonorrhœa either by establishing an immunity, general or local, or by the employment of an antiseptic effective against the gonococcus while harmless to the tissues, is still, however, an ideal very incompletely realised in practice. Meantime, by the adoption of a judicious compromise, it is possible to assert a control of the disease in so far that it can be localised in the anterior urethra, complications can be averted, and cure can be hastened.

*Prophylaxis* of gonorrhœa, a question of some

delicacy, but of much practical importance, is considered in the final chapter.

*The general treatment* aims at the removal of all influences favourable to the extension of the inflammatory process, and includes hygienic, dietetic, and antiphlogistic measures. Confinement to bed is only necessary in hyperacute cases or on the appearance of complications, but fatigue must be carefully guarded against, and during the acute stage all forms of exercise should be prohibited. Horse riding and cycling are particularly harmful, and even walking should be avoided as much as possible. The patient should drive rather than walk, sit rather than stand, and recline rather than sit. Scrupulous cleanliness should be maintained. The glans, prepuce, penis, and scrotum should be bathed two or three times each day with soap and water, and this may usefully be followed by an unirritating antiseptic lotion. The hands should be washed after each contact with the affected parts. Hot sitz baths, 105° to 110° F., before retiring to bed help to induce sleep and prevent erections. When micturition is excessively painful, immersion in hot water is often beneficial.

The patient should be warned of the contagious nature of the discharge. Attention should be drawn to the danger to his own eyes from unclean hands, towels, or water, as well as the risk of infecting others who may use the same toilet articles. A gauze or lint bag in which the penis is freely movable should be worn to protect the clothing. The practice of leaving a piece of dry wool adhering to the meatus and damming back the discharge cannot be too forcibly condemned. The only occasion on which this practice should be resorted to is when taking a bath.

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Chills should be guarded against, and the feet especially should be protected from damp and cold. Sleep should be secured by hypnotics if necessary, and a hard, cool bed in a well-ventilated room should be chosen. Every effort should be made to maintain rest of the affected region. Suspensory bandages are sometimes useful, but care must be taken to see that at no point is there any compression of the penis interfering with free drainage or blood supply. Suspensories as commonly used are more often harmful than helpful. It is of the utmost importance to avert all excitation of the sexual organs and to encourage a condition of mind which will keep the sexual function not only in a state of rest, but in abeyance. The inflammatory hyperæmia tends to induce involuntary erections and emissions, which exercise a serious influence on the course of the disease and are responsible, more than any other factor, for extensions and complications. This tendency may therefore have to be combated by anaphrodisiacs and sedatives such as camphor, potassium bromide, lupuline, adamon, anti-pyrine, veronal, trional, atropine, heroin, or morphia. Finger gives the following prescription :—

R	Lupuline	.	.	.	.	1·0
	Camphor	.	.	.	.	1·1
	Ext. Lupuli	.	.	.	.	q. s.
	ft. pil X.					

Sig. six pills daily.

Camphor monobromate in doses of five to eight grains in cachets may be taken once or twice before bedtime. To ensure sleep and freedom from erections, it is sometimes necessary to prescribe morphine in suppository form or as a hypodermic injection. When an erection occurs, it should be dealt with by the

application of cold water followed by the emptying of the bladder. Sometimes the immersion of the hands in cold water suffices to give relief, or a large warm rectal enema may prove efficacious.

The diet during the height of the inflammatory symptoms should be restricted to milk, carbohydrates, vegetables, and non-acid fruits. Asparagus, celery, tomatoes, shell-fish, lobster, ginger ale, pickles, sauces, spices, and condiments should be avoided. A safe rule is to prohibit any article of diet which "tickles" the palate. As the symptoms decrease in severity the dietary can be enlarged, fish, chicken, and red meat being allowed in moderation. The patient should be encouraged to drink freely to ensure a copious flow of dilute urine. Coffee is unsuitable in many cases, but weak tea with plenty of milk may be allowed. Barley water is an excellent drink, and Evian or any similar faintly alkaline mineral water may be prescribed for those who are not contented with plain water. Alcohol is, of course, entirely forbidden. The reason why all alcoholic beverages react so banefully on gonorrhœa is not easily explained, but there is abundant clinical experience to justify their entire prohibition during the whole course of the infection. Some continental authorities recommend a reduced allowance of light wine to patients who have been habituated to its use, but the safe course is total abstinence.

Regular evacuation of the bowels should be obtained by using, when necessary, a mild laxative such as cascara. Aloes and aloin should be avoided; and any drug such as citrate of lithia or carbonate of magnesium, which in some patients is prone to produce phosphaturia, should not be prescribed, as the passage of phosphatic deposit is exceedingly painful.

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*The internal treatment of gonorrhœa* is still the favourite and sole method of treatment adopted by the inexpert for three reasons: (a) its comparative harmlessness; (b) the small amount of trouble involved; and (c) the good results apparently obtained in many cases. Close clinical study of the after effects of the disease, as well as bacteriological control of the progress of cases, have, however, abundantly proved the insufficiency of the method and the folly of relying on drugs to effect a cure. There are several medicines, more especially some balsamics and aromatic oils, which have a beneficial effect on the more conspicuous symptoms of gonorrhœal urethritis, and there is no reason why they should not be used for the purpose for which they are suited, so long as they are recognised both by the doctor and patient as being subsidiary to the local treatment by which alone can the infection be controlled and the gonococcus exterminated.

The internal remedies which are in general use are copaiba, cubebs, sandal-wood oil, kava-kava, buchu, methylene blue, and the urinary antiseptics. The action of the balsamics is due to a local effect of their disintegration products on the mucous membrane of the urethra. These products are for the most part excreted by the kidneys, and they are therefore brought into contact with the urethral mucosa mainly during micturition. It is probable that the urethral glands play some small part in the elimination. The balsamics have little appreciable antiseptic action. That they do not inhibit directly the growth of the gonococcus is proved by the fact that the gonococcus flourishes on media to which the urine of patients previously dosed with balsamics has been added. Their therapeutic action is threefold: (a)

they relieve pain (an anæsthetic effect has been demonstrated on the eye of the rabbit); (b) they decrease the discharge and astringe the urethral mucosa; (c) they act as anaphrodisiacs (this effect is, however, uncertain and slight).

Their first effect is to stimulate engorged and torpid cells into activity, and their preliminary action is therefore to increase the discharge. On this account it is usually advised that they should be withheld during the few days in which the inflammation is at its height.

*Copaiba*, so far as European practice is concerned, has been longest in use. It is a fluid oleo-resin, obtained from the trunk of certain species of *Copaifera*. It has a yellowish colour, characteristic aromatic odour, and acrid, somewhat nauseous bitter taste. A large dose or persistent use is apt to produce dyspepsia, sickness, and diarrhœa. The dose is  $\frac{1}{2}$  to 1 fluid dram in capsules or emulsion. A tell-tale odour is emitted by patients undergoing treatment with this drug, and occasionally it produces erythema or roseola, or an urticaria due to indigestion. Ricord made free use of *copaiba*, and reports a case in which the presence of a fistula enabled him to demonstrate the value of the treatment in allaying the inflammatory appearances. The fistula communicated with the urethra and opened externally in front of the scrotum. In micturition the urine escaped through the fistula, but on closing the fistula by digital pressure the urine passed naturally from the meatus. Ricord prescribed *copaiba* and instructed the patient to urinate through the fistula. In a few days the "running" from this part was cured, while the anterior segment remained unimproved. By passing urine through the whole canal, cessation of the

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discharge was soon secured. Ricord noted that copaiba seemed to undergo some change in the process of absorption which was essential to the development of its curative properties, for injections of an emulsion proved comparatively useless, while the urine of patients ingesting the drug was efficacious as an injection. The active principles of copaiba and cubebæ are present in the urine as acids in combination with potassium or sodium, and the addition of a strong acid—for example, nitric acid—precipitates a white flocculent deposit, which is distinguishable from albumen by the fact that it is soluble in alcohol. Some patients are intolerant of copaiba, and its action not only on the digestive system, but on the urinary organs, must be carefully watched. On the appearance of albumen or blood in the urine the drug must be withdrawn.

*Cubebæ* is the dried unripe fruit of *Piper cubeba*. The dose is 30–60 grains of the powder and 30–60 minims of the oil. Cubebæ is less unpleasant to the palate than copaiba and less liable to upset the digestion. It is frequently prescribed along with copaiba either in pill, paste, or emulsion form. The powder may be administered in milk.

*Oleum Santali* is a pale yellow oil distilled from the wood of East Indian *Santalum album*. The dose is 5–30 minims in capsule or emulsion. The taste is aromatic and somewhat pungent, but it is much less irritating to the digestive system and to the kidneys than copaiba and cubebæ, and has therefore almost entirely displaced them in therapeutics. When ill effects follow the use of sandal-wood oil they may be due to impurities such as cedar-wood oil or West Indian sandal oil. The active principle is santalol, a sesquiterpen-alcohol. Occasionally a precipitate is

seen on the addition of nitric acid to the urine as occurs with cubebs and copaiba. Sandal-wood oil appears to have a specific antiseptic action on staphylococci in the urine, and this may apply to cocci generally (Jordan).

*Kava-kava* is the dried rhizome of *Piper methysticum* (Polynesia). The preparation used is the liquid extract in doses of 30–60 minims. It is not unpleasant in taste or after affects, and is similar in action to the other balsamics, but has a particularly strong anæsthetic effect.

*The salicylates* are frequently of service.

*Methylene blue* is now seldom employed.

*The urinary antiseptics*, such as hexamethylen-tetramine, salol, and boric acid, have no specific action, but their occasional use is of advantage, especially when instruments are being passed into the bladder. They must be used intelligibly, otherwise they will prove disappointing. The only drugs which need be considered are hexamethylen-tetramine, commonly known by the trade-name urotropine, and boric acid. The antiseptic action of urotropine depends on its power of forming formaldehyde in the urine; but this is only produced in an acid urine, and the higher the degree of acidity the more effective is urotropine as an antiseptic. The urine must therefore be tested in every case, and if found to be neutral or alkaline it may be possible to alter the reaction by administering the acid phosphate of sodium 30 or 60 grains, or sodium benzoate 15–20 grains, twice daily. Urotropine on a rare occasion may give rise to symptoms of intolerance, producing even hæmaturia and strangury. Now it must be admitted that a highly acid urine containing such an irritating constituent as formaldehyde is the opposite of the condition we desire to

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produce in acute urethritis, and therefore urotropine is not a suitable antiseptic for acute gonorrhœa. It is, however, of great value in the chronic stage with a mixed infection extending to the bladder.

*Boric acid* acts equally well in an alkaline urine, is an efficient antiseptic, and gives rise to no irritation of the urinary tract. It is therefore the antiseptic of choice in acute gonorrhœa.

*Uvæ Ursi* is a mild diuretic with a weak but distinct antiseptic action. The infusion is a suitable vehicle for exhibiting boric acid, e.g.—

R	Ac. Borici or Urotropine	.	gr. X.
	Inf. Uvæ Ursi	.	1 oz.
Sig. To be taken three or four times daily.			

The balsamics should be taken immediately after meals, with a view to decreasing their irritating action on the intestinal tract. It has been recommended that in order to obtain the greatest concentration of the remedial products in the urine, the quantity of fluid allowed should be limited, but the disadvantages of this course outweigh any possible gain. It must not be forgotten that however advantageous the balsamics may be in reducing the discharge to a minimal quantity and in relieving pain, this internal treatment alone will not effect a cure. Bacteriological examination will still reveal the continued presence of the gonococcus, and so long as the infection lasts there are the dangers of relapse, of complications, and of conveying the infection to others. Internal medication is not therefore in itself a method of treatment, but only an unessential auxiliary of more or less assistance to the local treatment. During the administration of the balsamics the precaution of periodical examination of

the urine should not be omitted, and on any appearance of nephritic irritation the medicine should be altered to a simple diuretic. Before collecting a sample of urine for examination, the patient should pass a portion of his urine sufficient to wash all pus from the urethra.

#### LOCAL TREATMENT OF ACUTE GONOCOCCAL URETHRITIS

Since the discovery of the gonococcus, the line of treatment most persistently followed has been local application of antiseptics in the hope of destroying the organism. In selecting an antiseptic there are three indications that influence the choice: (*a*) it should be active against the gonococcus in the urethra; (*b*) it should be unirritating even to the inflamed mucous membrane; (*c*) it should, if this be obtainable, be one which is capable of penetrating the living tissues and acting on the gonococci lying in the subepithelial layer. It should also be able to reach the depths of the glands and lacunæ in which gonococci are embedded. That there is no antiseptic or combination of antiseptics at present at our disposal which entirely fulfils these demands is true, and there is, therefore, still much room for improvement in the treatment of gonorrhœa. But sufficient progress has been made to establish local treatment in a position of considerable effectiveness, and to remove any justification there might at one time have existed for the policy of non-interference which found some advocates. The difficulty has been to obtain an antiseptic with penetrative power and non-irritating to the living tissue. No difficulty is now experienced in destroying all surface organisms without producing undue irritation, and clinical experience has taught that if this

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condition be maintained for a sufficiently long period the natural resistance of the patient, reinforced possibly by the use of vaccines, will be sufficient to deal with the tissue-embedded organisms. The results which can be relied on to follow the proper application of the best local treatment are : (a) the limitation of the infection ; (b) the prevention of complications ; and (c) the assurance of ultimate removal of infectivity. The mode of applying the antiseptic to the urethra has given rise to much discussion. There are two main schools typified by the French and the German, who uphold different methods. Janet, of Paris, elaborated and popularised the lavage treatment, by which a large volume of weak solution, usually of potassium permanganate, is made to flow over the urethral mucous membrane into the bladder, whence it is expelled by the patient. The other method is the injection of small quantities of stronger solutions, usually of silver preparations, by means of a hand syringe. Among other methods less generally used are irrigation of the anterior urethra, the insertion of solid bougies or semi-solid pastes in which antiseptics are incorporated, and the application of heat of a degree sufficient to destroy the gonococcus. The small syringe has, in general practice, a greater vogue than any other mode of treatment. Its reputed advantages are : (a) that it can be carried out by the patient ; (b) stronger solutions of the antiseptic can be employed ; (c) it can be applied more frequently ; and (d) it does not traverse the posterior urethra. When these assertions are critically examined, it can be said : (a) treatment would be attended with less risk and would be more effective if practised only by the surgeon or a skilled attendant ; (b and c) more thorough removal of

micro-organisms can be secured by the mechanical action of a large volume of solution used once or at most twice daily with less irritating, but equally sterilising effect on the urethra than by frequent injections of small quantities of stronger antiseptics; (*d*) this objection is more theoretical than real, and is charged with equal force by the advocates of the Janet system against the injection method. Many able clinicians have, however, after a prolonged test of the Janet treatment, reverted to the silver injections, and the main reason expressed when any is given is that complications (prostatitis, epididymitis, etc.) are less frequent with the latter form of treatment. Statistics are not forthcoming on their side, and the followers of Janet still successfully defend their position. My own preference is strongly in favour of the lavage treatment, circumstances allowing of its use. Unfortunately the time and trouble involved will, it is feared, prevent its becoming popular in general practice, especially when good results can be obtained by the careful employment of other means.

We will consider the different forms of treatment as applied to acute anterior urethritis in the following order :—

1. *Injection treatment.*
2. *Urethro-vesical washings* (Grand Lavage of Janet).
3. *Irrigation.*
4. *Thermic treatment.*
5. *Bougies, semi-solid pastes, ointments.*
6. *Bier treatment.*
7. *Lactic acid bacilli ; bacillus pyocyaneus.*
8. *Vaccines and serums.*

*The urethral injection treatment.*—A syringe is chosen which is capable of holding an amount of

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fluid sufficient to distend the anterior urethra, but small enough to obviate the risk of an excess of pressure being employed by which the resistance of the compressor urethræ muscle might be overcome and the fluid forced into the posterior urethra. The average capacity of the anterior urethra in health is from 8–12 c.c., but this is decreased in inflamed conditions, and a syringe with a capacity of two or three drams is therefore suitable. The asepsis of the syringe is of the utmost importance. An all-glass syringe with solid plunger and acorn nozzle is now on the market, and is the only form which should be employed (Fig. 24). The insertion into the inflamed canal of the old-fashioned tapering or olive-shaped



FIG. 24.

All glass urethral syringe.

nozzle was a constant source of irritation and pain. The acorn point fits into the meatus, and it can be kept in position as long as retention of the injection is desired. To attempt to hold the solution in the urethra by digital compression after withdrawal of the syringe means always some loss of the fluid, and the extremity of the urethra escapes treatment. The object aimed at by the small syringe technique is to bring the antiseptic solution into contact with the whole surface of the mucous membrane of the anterior urethra, and to maintain the contact for several minutes.

The glans, prepuce, and meatus are thoroughly cleaned and the bladder is emptied before the injection is begun. It is advisable to ensure that all urine

has been expelled from the urethra by moving the fingers along the canal from the bulb forwards, as the presence of urine vitiates to some extent the activity of the antiseptics. Cleansing of the canal by injections of warm water previous to throwing in the medicament has been suggested, but there is the obvious risk by this procedure of carrying gonococci into the posterior urethra, gonococci which have not been in contact with the antiseptic and whose virulence therefore is unaffected.

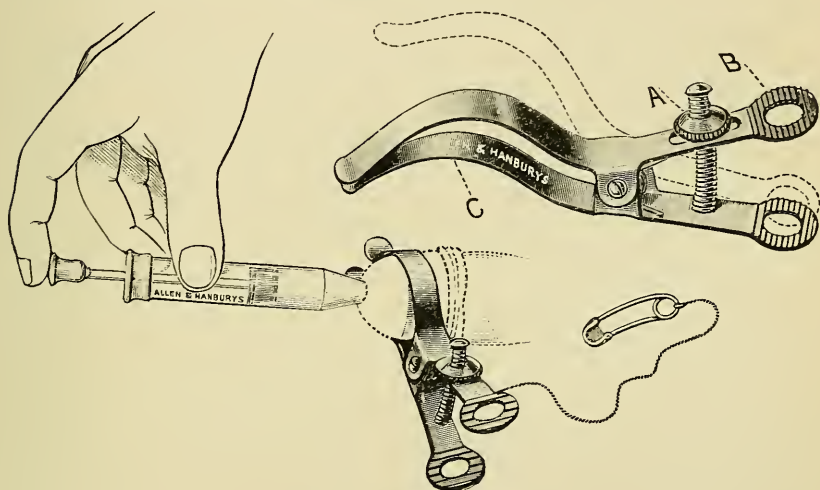


FIG. 25.

MacMunn's urethral clamp.

The solution, which should be about blood heat, is injected evenly and slowly until the urethra is completely distended, and the syringe is kept in position to prevent the escape of the injection for such time as has been decided upon. This depends on the strength of the solution employed and the acuteness of the inflammation present. In no case should it exceed ten minutes, as the compressor muscle might become exhausted, and relaxation would allow entrance into

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the posterior urethra. In attempting to abort an infection, it may be thought advisable to retain the antiseptic in the urethra for twenty minutes, in which case at least two syringefuls should be used with an interval of a few minutes between. There is some advantage to be gained by using two or three fillings of the syringe, retaining the injection each time for two or three minutes. It has been found that the antiseptics suitable for urethral use require in most cases a minimum of ten minutes to kill the gonococcus. It is true that the urethral surface is left moist with the injection, and it is difficult to estimate exactly how long the antiseptic action will continue, but it cannot be long before the injected solution becomes diluted with exudation, with which, moreover, it may react chemically and be rendered inert. Retention of the injection is therefore advantageous so long as the reaction which follows is not greater than is desired.

As a rule, injections are repeated every three or four hours, and whether they are used more or less frequently will depend on the strength of the solution employed, the acuteness of the symptoms, and the occurrence of the opportunity. They are begun as soon as gonococci are found, and used continuously until gonococci have disappeared from the smears and for some days thereafter.

During the night a long interval elapses in which neither by urination nor by injection is there any cleansing of the urethra, and it is then that an extension or a complication is most likely to be excited, especially if the patient is troubled with erections. It is seldom that during the acute stage of gonorrhœa an unbroken night's rest is obtained, and no harm but much good is got if the patient takes

advantage of the restless moment to empty the bladder, use his syringe, and have a drink of water.

In some cases either hypersensitiveness of the urethra or the irritating nature of the injection will call for the preliminary use of a local anæsthetic. As absorption readily occurs from the urethral canal, care must be exercised not to overdose with cocaine. One or two drams of a  $\frac{1}{2}$  per cent solution of eucaine or cocaine may be employed and allowed to act for a few minutes, or it may be possible to include anti-pyrene as an anæsthetic in the injection prescribed. Permanganate of potash produces a state of anæsthesia in about eight minutes, lasting two to five minutes, and a very dilute solution might be suitable for use in some cases. On the appearance of hyperacute symptoms, it may be necessary to withhold all kinds of local treatment or a change from injections to irrigation with a mild solution may be indicated.

#### REAGENTS EMPLOYED FOR URETHRAL INJECTIONS

The list of chemicals which have been used as injections is a long one, and many old-time favourites are forgotten. Before the discovery of the gonococcus, an astringent effect was the one quality required of an injection. They are now valued according to their antiseptic action, but many of those in use possess both astringent and antiseptic properties. The following table is far from complete, and new injections are being constantly proposed, which proves that perfection in the technique of urethral medication has not yet been attained.

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## REAGENTS EMPLOYED FOR URETHRAL INJECTIONS

	Strength for Injections.	Strength for Instillation.	Strength for Irrigation and Lavage.
1. Silver Nitrate ....	1 : 4,000 -1 : 2,000	1 : 500-1 : 100	1 : 10,000-1 : 4,000
2. Silver Fluoride ...	1 : 10,000-1 : 2,000	—	—
3. Actol (silver lactate) .....	1 : 10,000-1 : 4,000	—	—
4. Itrol (citrate of silver) .....	1 : 5,000 -1 : 2,000	—	1 : 10,000-1 : 4,000
5. Silver Iodide ....	1 : 20 -1 : 10	—	1 : 2,000 -1 : 500
6. Argentide (iodide of silver, 100 gr. to 1 oz.) .....	1 : 60 -1 : 30	1 : 20 -1 : 10	1 : 4,000 -1 : 2,000
7. Protargol .....	1 : 800 -1 : 100	1 : 200-1 : 50	1 : 4,000 -1 : 2,000
8. Argyrol .....	1 : 50 -1 : 5	1 : 10 -1 : 5	1 : 1,000 -1 : 250
9. Largin .....	1 : 400 -1 : 100	1 : 50	1 : 4,000 -1 : 1,000
10. Albargin .....	1 : 1,000 -1 : 100	1 : 20	1 : 5,000 -1 : 1,000
11. Argentamin ....	1 : 3,000 -1 : 500	1 : 100	1 : 30,000-1 : 10,000
12. Argonin .....	1 : 200 -1 : 30	1 : 15	1 : 4,000
13. Nargol .....	1 : 400 -1 : 100	1 : 20 -1 : 10	—
14. Hegonon .....	1 : 400	—	1 : 6,000 -1 : 2,000
15. Novargan .....	1 : 500 -1 : 50	1 : 20 -1 : 10	1 : 3,000 -1 : 1,000
16. Ichthargan .....	1 : 2,000 -1 : 500	1 : 300-1 : 100	1 : 5,000 -1 : 2,000
17. Collargol (colloid silver) .....	1 : 30 -1 : 20	—	1 : 10,000
18. Colossal Argentum	used undiluted as dispensed		
19. Ichthyol .....	1 : 100 -1 : 20	—	—
20. Resorcin .....	1 : 100 -1 : 25	—	—
21. Salicylic Acid ....	1 : 3,000 -1 : 2,000	—	1 : 5,000 -1 : 3,000
22. Boric Acid .....	1 : 30 -1 : 16	—	—
23. Carbolic Acid ....	1 : 500 -1 : 250	—	—
24. Picric acid .....	1 : 200 -1 : 100	—	—
25. Citric acid .....	1 : 500 -1 : 250	—	—
26. Lactic acid .....	1 : 500 -1 : 200	—	—
27. Tannic acid .....	1 : 300 -1 : 200	—	—
28. Nitric acid .....	—	—	1 : 5,000 -1 : 1,000
29. Bichloride of Mercury .....	1 : 20,000-1 : 10,000	—	1 : 30,000-1 : 20,000
30. Permanganate of potash .....	1 : 3,000 -1 : 1,000	—	1 : 10,000-1 : 2,000
31. Quinine bisulphate	1 : 1,000 -1 : 200	1 : 400	1 : 5,000
32. Thallin sulphate ..	1 : 250 -1 : 100	—	—
33. Hydrogen peroxide	1 : 100 -1 : 30	—	—
34. Iodine .....	—	—	1 : 2,000 -1 : 500
35. Mercury oxyeyanide	1 : 6,000 -1 : 4,000	—	1 : 10,000-1 : 4,000
36. Alum .....	1 : 500 -1 : 100	—	—
37. Copper sulphate ..	1 : 500 -1 : 250	—	—
38. Zinc sulphate ....	1 : 500 -1 : 100	—	—
39. Zinc sulphocarbonate .....	1 : 500 -1 : 200	—	—
40. Zinc chloride ....	1 : 2,000 -1 : 1,000	—	—
41. Zinc acetate .....	1 : 500 -1 : 100	—	—
42. Nizin (zinc salt sulphanilic acid)	1 : 240 -1 : 80	—	—
43. Lead acetate ....	1 : 250 -1 : 100	—	—
44. Bismuth subnitrate	1 : 50 -1 : 20	—	—
45. Bismuth citrate ..	—	—	1 : 3,000 -1 : 500

The above table contains no drugs which are obsolete, and each of them has some value. They might be divided into stimulants, sedatives, antiseptics, and astringents, according to the dominant feature which they exhibit when applied in practice, but most of them duplicate two or more of these functions. Thus the silver salts and silver organic compounds are essentially antiseptics with a specific antigonococcal action, but they can also be used to stimulate secretion or to produce an astringent effect if applied in suitable concentrations. Bismuth subnitrate is sedative and to some extent astringent, while zinc sulphate is used only for its astringent action. A selection of half a dozen or less of these medicaments will fulfil all requirements provided the action and dosage of each is mastered in detail. It is better to have a complete working knowledge of a few preparations than a hazy appreciation of a large number. One of the organic silver compounds of which protargol may be taken as a type is indispensable in the injection treatment of urethritis; nitrate of silver is essential in the declining stage in some cases; permanganate of potash is more generally useful than any other individual drug, and to complete an outfit an astringent such as sulphate of zinc might be included.

*Nitrate of silver* for many years, in fact since Ricord's time, held the first place in the injection treatment of gonorrhœa. Neisser proved its antiseptic powers over the gonococcus, and confirmed Ricord's estimate of its clinical value. It has not escaped criticism. It has been blamed as being responsible for the production of a considerable proportion of the strictures which are such a frequent sequel of an attack of gonorrhœa. The substitution

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of the organic silver combinations in place of the nitrate has certainly reduced the danger of stricture formation. But even before the day of protargol and its fellows, a reduction in the prescribed solution of the nitrate to below the laboratory bactericidal strength had enabled many clinicians to avoid the disastrous after-effects of the drug while retaining its curative powers. It is now used only in concentrations of from 1 in 6000 to 1 in 2000, except when wanted for an occasional application to small areas on the wall of the canal, where solutions of 2 to 5 per cent may be used provided an interval of several days elapses between each treatment. Solutions must either be prepared with distilled or rain water, or allowance must be made in calculating the strength for the counteracting effect of the chlorides present in the water. London water renders inert about 1 gr. per pint (Wyndham-Powell).

*Protargol* is one of the protein silver compounds. It does not coagulate albumen and is not precipitated by sodium chloride. It is decomposed by heat, and must therefore be prepared and used in the cold. Neisser suggested one injection to be retained for thirty minutes, and two others of five minutes' duration as the daily treatment. He recommended the prolonged application of the solution, hoping thereby to obtain a deeply penetrating effect. One long-continued injection is more irritating than three injections of moderate duration, say five to ten minutes. Ten or at most twenty minutes is now the time generally allowed, and two or three changes of the solution in the urethra is practised. Protargol is unirritating in concentrations below 1 per cent, but in acute urethritis it is wise to begin with  $\frac{1}{8}$  per cent or  $\frac{1}{4}$  per cent. Some authorities prefer to see the

patient daily, when they administer an injection of a strong solution containing a local anæsthetic. Thus Neisser now employs in this way a solution of protargol 3 per cent and antipyrine 5 per cent, retained twenty minutes; while the patient is instructed to use at home other two injections of a solution of protargol  $\frac{1}{4}$  per cent plus 3 per cent antipyrine, retained for five minutes. Neisser admits that this treatment is liable to irritate even to the extent in some cases of inducing a bloodstained discharge. These strong solutions have therefore not found general favour, and better results are achieved and with much less discomfort to the patient by beginning with weak solutions and gradually increasing the strength.

*Novargan*, an albuminate of silver, is reported to be less irritating than protargol. A suitable strength for injection is from  $\frac{1}{2}$  to 2 per cent.

*Argyrol*, another albumen compound (silver vitellin), is probably the least irritating of all, on which account it can be used in much stronger solutions even up to 20 per cent. A good working concentration is 5 per cent. It has the disadvantage of staining the hands, linen, etc., but the stains can be decolorised by immersion in 1 in 500 bichloride of mercury. It is less efficient as a laboratory antiseptic than the other silver-albumen combinations, but on account of its cleansing action it is useful for removing purulent secretion.

*Largin* is similar in composition and action to protargol.

*Albargin* is a combination of silver nitrate and gelatine. It is a soluble white powder, and the solutions are comparatively stable. As it dialyses through animal membranes it is said to have a deep penetra-

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tive action. A solution of from 0·1 to 1 per cent is employed.

*Ichthargan*, an ichthyol-silver compound, can, on account of its low cost, be used for irrigations as well as injections. For injections the strength should be from 0·02 to 0·2 per cent. Both ichthyol and ichthargan are, as a rule, unirritating, but in occasional cases a considerable inflammatory reaction is produced.

*Nargol* is a chemical combination of silver with nucleinic acid from yeast. Solutions of from 0·25 to 1 per cent are injected.

*Argentide* is iodide of silver in fine suspension ready for dilution. Iodide of silver being insoluble should be prescribed as *Argentide*, or in a mucilaginous mixture.

The silver solutions should be fresh, and therefore only small quantities should be prescribed. They should be prepared with distilled water, dispensed in dark-coloured bottles, and protected from the light. As most of the organic salts are decomposed by heat, they should not be diluted with hot water. It is better to prescribe a solution of the exact strength to be injected, and sufficient warmth can be ensured by the patient carrying the vial in his pocket.

The doses given in the appended table are in most instances lower than many practitioners are in the habit of prescribing, and it is not always necessary to begin with the lowest percentage. It is, however, safer to err on the side of moderation in this respect than to attempt to abort the disease by using concentrations which might excite an excessive reaction and induce complications. Over-treatment is undoubtedly dangerous, and has to be as carefully avoided as timorous treatment. Only careful supervision of each case with the aid of the microscope can decide the correct course to pursue.

Many reports of laboratory experiments to test the bactericidal power of the different antiseptics in use, with special reference to the gonococcus, have been published. The most contradictory results have been obtained, due in some instances to difference in technique. The negative results obtained with the organic silver preparations by some American workers are meantime insufficient to outweigh the strong evidence in favour of their antiseptic properties obtained by many careful investigators in Germany and elsewhere. In any case, the clinical evidence is overwhelmingly in favour of the albumen-silver compounds in particular. It is impossible to create in the laboratory exactly the conditions obtaining in the urethra, "the living culture tube." The urethral exudate contains antibodies which are, of course, absent from the culture tube used experimentally, and this may be one of the features determining the susceptibility of the gonococcus to the silver salts.

The effect of the injection is therefore (1) to destroy or at least weaken the gonococci with which it comes into contact; (2) to alter the urethral mucous membrane in such a manner as to render it an unsuitable medium for the growth of the gonococcus; (3) to mechanically cleanse the urethra. The cleansing effect is of minor importance in this method of treatment. If this were the object in view, injection of small quantities of viscid fluid would not be the means which would suggest itself. Possibly the most important result of the injection is the change which it produces in the urethral mucosa. There is here still a field for useful investigation, and meantime the clinical results must be accepted as deciding in favour of the value of the silver compounds.

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### URETHRO-VESICAL LAVATION<sup>1</sup>

To Janet belongs the credit of perfecting and popularising the method of urethro-vesical lavation by hydrostatic pressure, which he calls "Grand Lavage." The kernel of his teaching is that no irrigating instrument should be passed along the canal, but that both an inward and an outward rinsing of the entire tract should be obtained by filling the bladder from a column of solution having sufficient pressure to overcome, with certain adventitious aids, the resistance of the sphincter muscles. It might be objected that by this procedure we are violating the sanctuary of the posterior urethra, a risk we take precautions to avoid when practising urethral injections. The conditions in the two cases are, however, entirely different. In the first place, in injecting a small quantity of fluid into the urethra the portion which finds its way behind the compressor urethræ is retained there, and it may have carried before it a droplet of pus collected in the bulb between the previous act of micturition and the actual injection. Again, the antiseptic may not be intimately mixed with the infective secretion.

On the other hand, in lavation the anterior urethra is thoroughly washed free of all secretion with a large quantity of antiseptic fluid (500 c.c.) immediately before entrance to the posterior urethra is attempted, and any organisms finding their way into the posterior tract are expelled on the completion of the operation by the patient clearing his bladder of

<sup>1</sup> The revival of this almost obsolete term is I think justified by the difficulty of expressing in English exactly what Janet means by "Grand Lavage" and the confusion which is apt to arise when the words "washing," "rinsing," or irrigation are used.

its contents. Any stray cocci which may obtain a lodgment in a crevice of the posterior urethra or of the bladder will, if still capable of seeking a livelihood, find a very uncongenial soil in a mucous membrane saturated with permanganate. However, the real test is clinical experience, and it is not maintained by any careful observer who has given a sufficient trial to this method of treatment that it increases the risk of posterior urethritis and its complications. On the contrary, one of the advantages claimed for lavation is that not only does it greatly increase the patient's comfort, but that the incidence of posterior extension is considerably reduced.

The one blemish which detracts from the general usefulness of this treatment is the natural disinclination of a busy practitioner to undertake the somewhat arduous and time-consuming task. Where there is a sequence of cases to be treated and special apparatus and accommodation can therefore be afforded, no other treatment will give the same satisfaction either to the patient or practitioner.

When a patient enters consulting-rooms where there are no conveniences suitable for the examination and treatment of acute gonorrhœa, the surgeon naturally dislikes to properly examine the patient, let alone treat him. The prospect of drops of pus falling on the carpet, or pus-contaminated hands fingering the furniture or door-handle, makes the unfortunate patient too often an unwelcome intruder, and the fight between the doctor's conscience and his feelings one in which the right may not always win. Every surgeon who is going to undertake such cases, and no more interesting and unwrought field of work is now open to the medical profession, ought to make such arrangements for the reception of these cases as

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will ensure an aseptic performance both of diagnosis and treatment. This involves the installation of at least one special apartment furnished and fitted on

hospital lines. The floor is covered with linoleum, the chairs and couch are white enamelled iron. An instrument cupboard, one or two aseptic tables with lockers, a wash-hand basin, an enamelled slop pail, and an irrigating apparatus on stand or pulley (Fig. 26) complete the major part of the outfit.

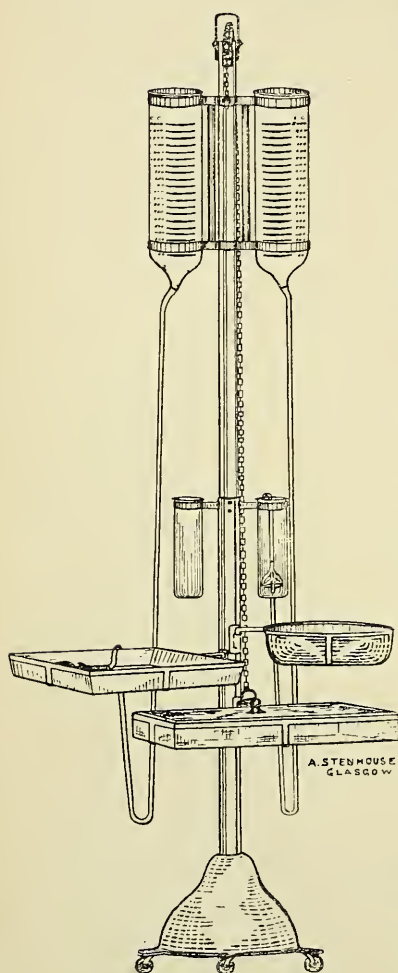


FIG. 26.

For the purpose of washing out the urethral tract by Janet's method, the patient, after urinating and having sufficiently undressed, lies on the couch with a urological basin (Fig. 27) between the thighs. The reservoir containing a litre of warm solution is hoisted so as to rest from  $3\frac{1}{2}$  to 5 feet above the level of the table. The region of the prepuce and glans having been thoroughly cleansed with swabs

and antiseptic lotion, the urethral canula (Fig. 28) is inserted, the tap partly turned forwards, and the anterior urethra is gently filled to complete distension and then emptied several times in succession.

About half of the solution is utilised in this way and the bladder is then filled. To accomplish this the patient is told to relax his muscles, breathe deeply, and make gentle efforts as if to urinate, and the full pressure of the irrigator is turned on. It will then be found, if successful, that the solution is flowing into the bladder, and when complaint of fullness is made the canula is withdrawn, and the patient expels the bladder contents. The permanganate, when this salt is used, will be found to have been more or less reduced, as evidenced by its colour, according to the proportion of urine with which it has been mixed.

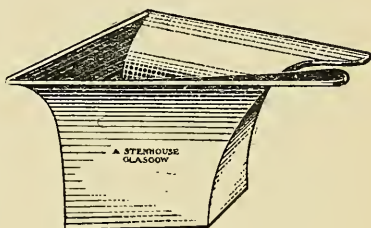


FIG. 27.

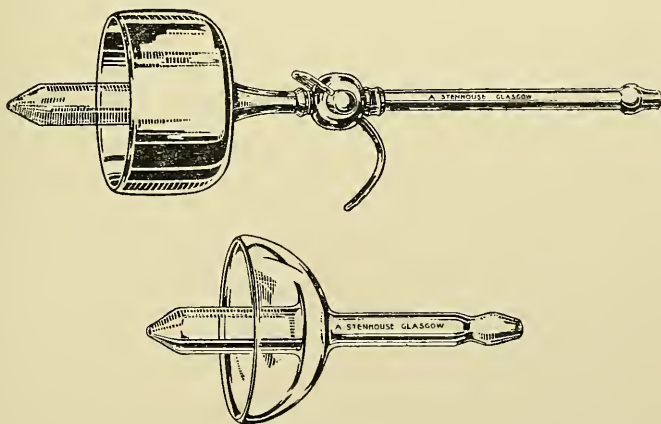


FIG. 28.

If the attempt is not successful it is due to the hypercontraction of the compressor urethræ either from the reflex stimulation of a too cold solution, a hypersensitive urethra, or spasmodic contraction in

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a nervous patient. The temperature of the solution should be above lukewarm, but not hot, 100° to 104° F. A second attempt may succeed when the patient understands better what is required of him. Rarely is a local anæsthetic required, although many surgeons make this a routine procedure, using two drams of a 1 per cent solution of eucaine lactate or stovaine, which is retained in the urethra for five minutes, and part of it insinuated into the posterior urethra by digital manipulation.

Many of the criticisms which one reads of the "irrigation" method are really aimed at irrigation confined to the anterior urethra. The results of anterior irrigation are not good. The posterior urethra frequently becomes involved, and not only does it remain untreated, but the spasm induced by prolonged anterior irrigations tends to increase the acuteness of the symptoms and to incite complications.

Lavation, like all other forms of local treatment, is contra-indicated in hyperacute cases, but otherwise there is no reason to withhold it in any stage of urethritis.

### SOLUTIONS EMPLOYED IN LAVATION

*Potassium permanganate*.—The agent which is most generally useful is permanganate of potash in concentration of from 1 : 10,000 to 1 : 4000 and rarely 1 : 2000. Beginning with the weakest solution, daily or twelve-hourly treatments are continued with gradual successive increases in the strength until all discharge has disappeared and the urine is clear. Usually this occurs within a fortnight, and thereafter, in the absence of the gonococcus from the smears, the lavations can be given with two, three, and

seven day intervals respectively. Repeating the treatment twice a day is, as a rule, only feasible when the patient can be taught to carry out the process himself, and this will seldom be found practicable.

The more frequent the irrigations the weaker should be the solution. The 1 : 2000 concentration is seldom called for, and never in acute urethritis. With 1 : 4000 we should be able to finish the treatment satisfactorily. No after-effects should be felt by the patient other than a slight sensation of heat lasting for perhaps an hour.

A concentrated solution of sodium bisulphite or of oxalic acid will remove the stains on hands or clothing produced by permanganate.

*Albargin*, 1 in 2000, may be substituted for the permanganate for a few days in refractory cases. Other salts which may be employed are included in the table on page 94.

*Lavation by means of a large syringe.*—According to the French literature it would seem that their surgeons have seldom or never any difficulty in practising “grand lavage.” This is doubtless largely owing to expertness resulting from experience, but it is possibly also due to some extent to the facility with which the patients can comply with instructions. Whatever the explanation, there is certainly found in this country a small proportion of cases where no patience or expedient will get the fluid past the sphincter. On this account it is well to be supplied with a large syringe (100–150 c.c.) with which the procedure can be completed. A carefully made instrument with metal plunger and finger loops is illustrated in Fig. 29; a rubber tip and metal or vulcanite shield are necessary additions. In using

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this syringe the motive is to insinuate the solution into the posterior urethra, whence it gains the bladder, by sudden short plunges during quiescent conditions of the sphincter. At other times the solution will enter without difficulty on continuous pressure being exerted, but care must be exercised to avoid forcing a passage. It is no use fighting the sphincter, it has to be "dodged." A delicate touch can readily appreciate the condition of the sphincter. Our control over the action of the syringe is complete, and as we can vary the amount and incidence of the pressure as required, a large syringe is a valuable addition to our armamentarium.

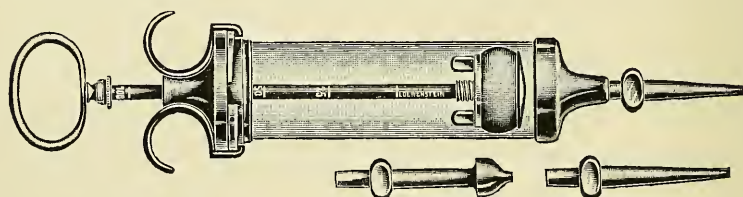


FIG. 29.

Albarran's vesical syringe.

Whether the reservoir or the large syringe is employed, the whole procedure must be carried out in such a systematic and gentle manner that no injury is done to the inflamed mucosa. If there is any doubt as to our ability to avoid traumatism, or if pain be complained of, this method should be abandoned and recourse had to small syringe injections.

No instrument can be allowed to penetrate the posterior urethra during the progress of an acute urethritis, therefore filling the bladder by means of a catheter or other irrigating instrument which passes through the sphincter is unwarrantable. Complications and extensions are invited by such treatment.

The routine use of rectal suppositories of atropine sulphate, as practised by Schindler, in doses of  $1/75$  of a grain twice daily, reduces to a minimum the dangers of vesiculitis and epididymitis, and is therefore to be recommended.

#### ABORTIVE TREATMENT

Provided that the gonococcus is found in the urethra before the appearance of a purulent discharge, it may be possible, by the adoption of especially energetic measures, to prevent the development of an acute urethritis. When the case comes under observation more than twenty-four hours after the onset of the first symptoms, the prospects of success are remote; but no absolute time limit can be stated. The only criterion is the degree of inflammation presented. When the appearance of the meatus is normal, and the small quantity of gonococcus-bearing discharge which can be expressed is mucoid in character, an attempt to abort the disease should be made. A short incubation period is an unfavourable indication, as it suggests either a weak resistance on the part of the patient or a special virulence of the particular strain of gonococcus. Suitable cases are seldom seen in dispensary work, but in private practice the number of patients seeking advice soon after an indiscretion is increasing with the spread of a clearer conception of the symptoms of the disease.

It must be distinctly understood that in speaking now of abortive treatment we refer simply and solely to an attempt, not to cut short an urethritis already in being, but to stamp out the infection before it can give rise to its characteristic acute inflammatory reaction. Abortive treatment, wrongly so called, when

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aimed at the suppression of an already present acute gonorrhœa, is not only unwise on account of the painfulness of the procedure, but frequently disastrous both in its immediate and remote effects. The whole *raison d'être* of abortive treatment is based on a reasonable hope that the gonococcus has not penetrated beyond reach of the antiseptic, and that the whole family of invaders can be destroyed. It is a very attractive proposition, but unfortunately it is not sufficiently often realised in practice, and in the event of failure many of the recommended treatments have an unfavourable influence on the course of the gonorrhœa. It must be accepted that no method of abortive treatment is justifiable which in the event of non-success will increase the acuteness of the sequent gonorrhœa.

Every case in which the gonococcus has been implanted in the urethra does not develop into an acute urethritis. Thus it has frequently been noticed, that of several men cohabiting with the same infected female, one or more suffer from an acute attack of urethritis, while others remain free from symptoms. Of those who escape the probability is that some are "carriers" of the gonococcus, but being possessed of a relative immunity they successfully resist the gonococcus, which sooner or later disappears from the urethra without having produced symptoms. A proportion of the reported cures credited to abortive treatment are doubtless cases belonging to this category, but even so these "carrier" cases require to have their urethras sterilised, and the sooner the better. One cannot question the possibility of abortive treatment being really successful in a proportion of cases, provided, as already said, the treatment is initiated sufficiently early.

The method most generally useful in this connection is the injection into the anterior urethra by means of a small syringe of a comparatively strong solution of one of the organic silver compounds. Taking protargol as a standard, immediately on the diagnosis being completed an injection of a 1 to 2 per cent solution is undertaken, the injection being continued for ten minutes with one or two intervals for renewal.

The first injection should be of the maximum strength and of the maximum duration which the patient can bear without much discomfort, as in abortive treatment the initial injection is the most important. The concentration and duration of the succeeding injections will be determined by the reaction which has taken place in the interval. The injection, if well borne, should be repeated twice daily for three days, when it is reduced to  $\frac{1}{2}$  to 1 per cent. This should be combined with the administration of atropine suppositories (1/75 grain) night and morning, and 15 grains of urotropine or other urinary antiseptic along with a copious intake of fluids and the usual restrictions as to diet and exercise.

These injections should be performed by the medical attendant, and should only be repeated in the absence of pronounced inflammatory reaction. If necessary the intervals between injections are extended or the retention periods reduced.

Protargol is perhaps not the best preparation for this type of treatment. One of the less irritating compounds would be more suitable. Thus 10 per cent argyrol or 5 per cent novargan, preferably the latter, might be substituted.

Where success has been achieved it may be anticipated that the gonococcus will have disappeared from the smears by the second or third day of treat-

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ment; but as there are probably still some pus flakes to be seen in the first urine glass, the injections of the weaker concentration should still be continued for two or three days, when all treatment may be suspended in the absence of symptoms. The patient should, of course, be kept under observation during the following weeks, and instructed as to the appearances which would act as a warning of threatened recurrence.

One precaution which requires the strictest observance is surgical cleanliness of the urethral canal. To allow the meatus after an abortive injection to come into contact with an unclean prepuce or a stained shirt would make the whole performance futile. The glans, coronal sulcus, and prepuce must be carefully sterilised with oxycyanide of mercury 1 : 1000, followed by the silver solution. The penis is wrapped in a gauze dressing, and the patient is directed to change his underclothing and linen immediately, and use a fresh gauze dressing each time he urinates.

*Abortive lavation.*—In a percentage of cases which is estimated as high as 25 per cent in the opinion of some observers, the posterior urethra is involved from the first day, and therefore any treatment which does not include the posterior division of the canal will in these cases be ineffectual. On this account, Janet and his followers, when practising abortive treatment, adopt lavage with strong permanganate solutions frequently repeated.

Lebreton's results show that when suitable cases are chosen strong solutions are unnecessary. He advises concentrations of from 1 : 5000 to 1 : 10,000, repeated every twelve hours for four days and every twenty-four hours for other four days. In addition

to these "grand lavage" treatments, he asks the patient to syringe the anterior urethra several times in succession with weak permanganate after each micturition. Performed in this manner, lavation is without risk and promises well.

Oxycyanide of mercury or one of the silver compounds may be used instead of permanganate of potash, so long as solutions which produce irritation are avoided.

*Treatment of urethritis by applying heat to the urethra.*—The fact that a temperature of 44° C. maintained for ten to twenty minutes, or of 45° C. for one minute, is sufficient to destroy some cultures of the gonococcus naturally led to attempts to utilise this laboratory observation in practice.

While a few first reports of the use of special electrically-heated appliances have been enthusiastic, a larger experience failed to confirm the hopes as to their value. The failure was due to the impossibility of attaining more than a superficial action of the heat, and to the heat-resisting powers of some strains of gonococci. The rapidly circulating blood stream prevents the tissues being affected to the requisite degree. Some recent reports seem to indicate that it may still be found possible to make this method therapeutically useful. It might be worthy of trial as an abortive treatment in the early stages of an anterior urethritis in conjunction with the application of a tourniquet to the root of the penis, and in the later stages in conjunction possibly with vaccine treatment.

There are two types of appliance for urethral thermotherapy: (a) electrically-heated bougies, and (b) double-channel catheters for the circulation of hot water. The apparatus and the method of its

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application will be described under the treatment of chronic urethritis.

*The use of Bier's hyperæmia in acute gonorrhœa* has been favourably reported upon by Miles, of Edinburgh. A special vacuum chamber is manufactured for the purpose of receiving the penis. The congestion is maintained for one hour with intervals of relaxation every twenty minutes, and the treatment is applied daily. The results reported, while good, are not better than can be obtained by less cumbersome methods, and the danger of systematic infection is probably increased by the adoption of this method of treatment.

*The insertion of medicated bougies.*—Bougies made with a cocoa-butter or glyco-gelatine base and containing protargol, nargol, or another of the silver compounds, have been somewhat extensively used; but as their retention is liable to incite complications and posterior extensions, they should be employed with great reserve, especially in acute conditions.

### TREATMENT OF ACUTE POSTERIOR URETHRITIS

The mucosa of the posterior urethra presents a soil less fertile than that of the anterior for the growth of the gonococcus. Uncomplicated gonococcal inflammation of the posterior urethra is in consequence more amenable to treatment, especially prophylactic treatment. In fact, it tends to spontaneous cure in from ten to fourteen days.

Posterior urethritis owes its importance to the fact that from it originates the great majority of the complications to which gonococcus-infected patients are liable, and the treatment is dominated by this consideration.

More or less involvement of the prostatic ducts is present in all cases, and whether or not this will give rise to symptoms of prostatitis and thus constitute a complication, will depend on the depth to which the process extends. The ejaculatory ducts and the prostatic utricle are also liable to attack, and the latter especially is likely to become a site of chronic disease unless the inflammation is checked by early treatment.

The treatment which should be adopted depends on the condition of the parts when the case first comes under observation. The local treatment must be performed wholly by the medical attendant.

*Hyperacute cases* in which in addition to the symptoms of a florid anterior urethritis there is considerable pus in the second urine glass, frequent painful micturition, tenderness and terminal hæmaturia, require complete rest in bed. All local treatment should be postponed for some days. Urinary antiseptics are given internally. Sandal-wood oil in 10 m. capsules, giving four to six each day, is of considerable advantage, but is preferably withheld during the first two days of treatment. Hot rectal douches through a prostatic rectal tube and prolonged sitz baths are of great value in relieving the dysuria and tenderness.

The insertion night and morning of atropine suppositories,  $1/75$  of a grain in each, relieves spasm, and reduces the risk of extension to the vesiculæ seminales and epididymes; or to ensure more rapid action and accurate dosage the atropine may be given hypodermically. Morphia in small doses may be combined with the atropine when necessary. Morphine and sitz baths will give relief in almost all cases of retention of urine unless there is much

swelling of the prostate, when the passage of a small-sized soft catheter may be necessary.

The terminal hæmaturia seldom requires special treatment, but, if severe and interference essential, it can be controlled by instillations through a soft catheter of adrenalin 1 : 1000 and cocaine 2 per cent.

Seminal emissions, which are so frequently both injurious and distressing in this disease, are combated by camphor, potassium bromide, heroin, or morphia.

*In cases of moderate severity*, or when the intensity of the symptoms has been relieved, local treatment can be undertaken, and the only method which can be recommended is the Janet lavage with weak permanganate solutions. The lavation has to be repeated every twelve hours until sufficient improvement, as shown by suppression of the discharge and disappearance of the gonococcus, has been obtained to allow of greater laxity, when twenty-four, thirty-six, and forty-eight hour intervals are progressively attained. The constant use of the atropine suppositories enables the treatment to be continued even in the presence of subacute prostatitis.

The development of an acute posterior urethritis during the course of an anterior urethritis which is being treated with lavation is impossible if the treatment is being carried out with proper regard to intervals and concentrations; but, in the event of such an extension, the bladder fillings need not in ordinary cases be discontinued. Probably what would be required would be more frequent lavage, say every twelve hours.

Prostatic massage is reserved until the subacute stage, when it is certainly helpful to express the contents of the ducts, which are then open to the action of the subsequent antiseptic wash.

*The treatment of acute posterior urethritis by instillations* through the Diday, Ultzmann, or Guyon canulas or catheters has been, and still is, practised to a limited extent. Instillation into the posterior urethra of silver nitrate or of the organic silver solutions has a certain justification in subacute and chronic conditions ; but it is a procedure which cannot be practised with sufficient thoroughness and frequency in the posterior urethra to warrant its consideration as a means of treating acute posterior urethritis.

## CHAPTER VI

### CHRONIC GONOCOCCAL URETHRITIS

By the phrase "chronic gonococcal urethritis" is meant a chronic inflammation of certain portions of the urethra due to the continued presence of the gonococcus after complete (though temporary) tolerance is displayed by the major part of the urethral mucosa and a modified tolerance by the affected areas for the particular strain of organism concerned. The tolerance is only relative and is labile—that is to say, an acute inflammation may follow exposure to a fresh infection and an exacerbation may result from alcoholic and sexual excesses, vaccine injections in improper doses, and other causes which affect the acquired immunity in ways which at present can only be conjectured.

It has already been pointed out that a certain amount of immunity is acquired by the formation of antibodies in the blood stream, that the power of this immunity varies in different individuals, and that it is short-lived. It is probable that in any given case it applies only or principally to one of the several strains of gonococci which exist.

In addition to this general immunity a local resistance is developed, mainly by a metaplasia of the urethral epithelium, the cylindrical cells becoming replaced by cells of the squamous variety. The epithelial lining of the glands, however, does not

participate so early or so completely in this change into resistant tissue, and it is therefore for the most part in the glands that we find the sites of chronic infection.

These alterations in the medium ultimately affect the virulence of the gonococci, and transplanting to a fresh soil is required before the organism regains its virulent character. A condition nearly approaching equilibrium thus becomes established between the gonococci and the tissues, and as a result all evidence of the activity of the organism, so far as acute inflammatory reaction is concerned, is wanting.

Post-gonorrhœal conditions, whether due to organisms following in the train of the gonococcus or to anatomical lesions resulting from the pathological processes incited by the gonococcus, must be strictly differentiated from chronic gonococcal urethritis in which the gonococcus is still present.

It is necessary to distinguish with as great an amount of accuracy as it is possible to attain between chronic gonococcal and post-gonorrhœal lesions. In the one case, the patient is liable to fresh outbreaks of gonococcal activity in any of its possible directions, and what is of even more consequence he is still capable of infecting others, while the sufferer from post-gonorrhœal conditions who is rid of the gonococcus is at least free from these serious risks.

Chronic gonorrhœa in men is more consistently infective than is the same disease in women, because at each coitus the mixed secretion of all the glands of the male tract, including those harbouring the gonococcus, is thrown into the vagina, while only a fractional part of the female secretions gains entrance to the fossa navicularis.

The more exact methods of demonstrating the

presence of the gonococcus now available enable the diagnosis to be made with a sufficient degree of assurance for practical purposes, and both from the pathological and clinical points of view the classification of chronic affections of the urethra resulting from an acute gonorrhœa falls naturally into gonococcal and post-gonorrhœal, the latter assuming the absence of the gonococcus.

It is not possible to state in terms of time limits when a gonorrhœa can be designated as chronic. An acute gonorrhœa is usually understood to run its course in six or eight weeks, but in certain instances this period is exceeded either from improper treatment or special susceptibility on the part of the patient, due perhaps to concurrent tuberculosis or syphilis, or to a particular delicacy of his mucous membranes. Such cases should be called "protracted gonorrhœa." Again, some cases show a definite tendency to relapse, an acute exacerbation following before the termination of the declining stage; these are properly alluded to as "relapsing" cases. Finally, the occurrence of complications such as prostatitis or epididymitis may prolong the course, and then the term "complicated gonorrhœa" is applicable.

Excluding such cases as the above, when a patient remains uncured after ample time has been allowed for the fulfilment of the declining stage, the term "chronic" is justifiable.

Among the conditions which favour the issue of chronicity are—

(1) *Improper treatment or conduct.*—The absence of efficient treatment is the most frequent cause of cases becoming chronic, and next in importance is the failure of the patient to follow the rules of conduct laid down for his guidance, especially with regard to

abstinence from alcohol and rest of the sexual functions. Treatment which is too energetic and maintains a state of urethral irritation is also responsible in a few instances.

(2) A debilitated state of the patient's health, such as may be associated with tuberculosis, syphilis, and many other diseases, may indefinitely prolong the course of a gonorrhœa.

(3) *Mucous membrane peculiarities*.—Some individuals exhibit a particular tendency to chronic catarrhal affections.

(4) *Anatomical abnormalities*.—Para-urethral passages, large lacunæ, long or dilated ducts may be the seats of a long-continued infection. A narrow meatus, while a protection against infection, is an agent in the development of chronicity by interfering with active treatment and by retarding drainage in the acute stage.

(5) Many cases can only be accounted for on the somewhat indefinite ground of failure of the immunising mechanism.

*The symptoms of chronic urethritis are*: the appearance at the meatus of a small amount of mucopurulent discharge, and the presence of flakes and threads in the first urine glass. The patient seldom makes any complaint of discomfort unless the posterior urethra is deeply involved. The secretion is found in most abundance before urination in the morning, owing partly to the long interval between the acts of micturition and partly to a slight increase in the morbid process in the night time. Drying of the secretion at the meatus may seal the lips, behind which the drop of muco-pus is found. The absence of this secretion does not negative the possibility of the gonococcus being present, but it is usually the

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continuance of this "morning drop" which sends the patient to the surgeon for treatment.

When the posterior urethra is involved there may or may not be symptoms of interference with the sexual or urinary functions. Disease of the colliculus seminalis is especially prone to produce these disturbances, but the nervous constitution of the individual is perhaps the most active factor. It requires the exercise of considerable judgment as well as careful urethroscopic and bacteriological control to determine in which cases to continue a prolonged course of local treatment on account of the risk of pandering to a sexual neurasthenia; but on the other hand, it is remarkable what excellent results can be obtained in some of these cases by the institution of a course of appropriate treatment after an accurate and complete diagnosis has been made. The symptoms complained of include discomfort and straining at the conclusion of urination, emissions, leakage of prostatic, or on rare occasions spermatic secretion especially when at stool; pain referred to the end of the penis, the testicles, the perineum, the back, the region of the bladder and spermatic cords and down the thighs, and also pain on erection and ejaculation. Patients afflicted with these symptoms are not far removed from neurasthenia.

*The diagnosis* depends on finding the gonococcus in smears or cultures. A chronic catarrhal state of the urethra is of fairly common occurrence. Where series of observations have been recorded in medical clinics, the percentages in which urinary filaments were noted have varied from 30 per cent to 50 per cent. These figures have been extracted from German sources, and they exceed the experience in this country; but the important question is, what

proportion of cases of chronic urethritis harbours the gonococcus? Scholtz gives as a result of his careful investigations 10 per cent as the approximate number. While unable to accept Scholtz's estimate of the prevalence of chronic urethritis, I believe he considerably understates the proportion of cases of chronic urethritis following gonorrhœa in which the gonococcus can still be found. The vital point in the search for the gonococcus in chronic conditions is the method of collecting the material. As this is a question of much importance it will be considered in detail, although this will entail some repetition of matter already discussed.

In the first place, the secretion collected within the meatus in the morning, or at least after a long interval since the last urination, should be removed by the insertion beyond the fossa navicularis of a sterile wool-wrapped probe of suitable calibre.<sup>1</sup> The secretion is smeared on to a couple of clean glass slides which are stained by Gram's method and examined systematically over their whole surface until typical gonococci are found or until one is satisfied of their absence. The other organisms present should be identified so far as this is possible and their relative numbers noted. Where adventitious bacteria are present in such quantities as to obscure the gonococci, they may be reduced by injections of weak perchloride solution (1 : 10,000–1 : 20,000) on a few consecutive days, when the field will be more easily scanned and

<sup>1</sup> One of the many excellent suggestions of Sister Frisby of the Glasgow Lock Hospital is to enclose the wool-covered probes in glass tubing and to plug the tube with wool before sterilising. This overcomes the tendency of the wool wrapping to become loosened in the sterilising process, and is a safe method of keeping the probes sterile until wanted. For this purpose straight probes are required, but the handle can be bent to an angle when in use if desired.

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the gonococcus differentiated. If these smears reveal no gonococci, another specimen should be obtained direct from the surface of any infiltrated area seen through the urethroscope, using either the cotton-covered probe or a spoon to collect the secretion.

In the event of the search for the gonococcus being negative, it is necessary to proceed to some method of irritation in order to stimulate any latent organisms into renewed activity. The hyperæmia and œdema which follow an irritating application to the urethra re-establish the conditions suitable for a temporary rejuvenescence of the gonococcus colonies. The slight exacerbations induced by the provocative tests soon disappear under appropriate treatment.

The processes available for this purpose are—

1. The passage of a dilating sound and its retention in the urethra for a few minutes.
2. Massage with the button-tipped probe (applicable to the anterior urethra only).
3. The urethral injection of nitrate of silver solution (1 gr. to the ounce).
4. The hypodermic injection of a small dose of gonococcus vaccine (5–20 millions). Coincident with the “negative phase” renewed gonococcal activity is noticeable.
5. Allowing the patient to partake of alcoholic drinks or condiments such as pickles in sufficient quantity.

Massage with an acorn or button tipped probe is performed by extending the penis on the abdomen after inserting the probe as far as the bulb and then exerting some pressure on the penis with the left hand, while the right conducts the movements of the probe. In this way, the contents of glands and lacunæ are extracted, and being collected on the

shoulder of the probe can be used for microscopical examination. The largest probe which will pass the meatus should be chosen, and of course no lubricant should be used. Infiltrations which impinge on the urethral lumen can be diagnosed by the use of these probes.

On the morning of the day following any of the above measures the secretion is examined as before, when, if the organism is still present in the urethra, it will almost surely be found by an experienced examiner.

For the posterior urethra the most suitable local interference is the injection of silver nitrate through the Ultzmann syringe. The passage of a sound, while effective, is not without risk of exciting an epididymitis, though this can be minimised by atropinising the patient. The posterior secretions are obtained by rectal massage and expression after the anterior urethra has been washed out. Secretion can also be obtained direct from the mucosa of the posterior urethra by the use of the urethroscope.

Cultivation of the gonococcus should be attempted in each case, not only because success corroborates a positive microscopical finding, but also for the reason that in an odd case when the smear examination has been fruitless the tube may show some colonies.

Specimens of flakes and threads may be fished from the urine or urethral washings and examined microscopically for the gonococcus, but as a rule little evidence of any diagnostic value can be got from them. They will be found to consist of mucoid material, epithelial cells, leucocytes, and usually some micro-organisms. The presence of a number of pus cells is suggestive of gonococcal urethritis.

It is necessary to inform ourselves of the locality from which these filaments have been derived—to know, in fact, whether we are dealing with a chronic anterior or with a chronic posterior urethritis, or both.

The ordinary separate glass test is of no assistance in the elucidation of this question. The secretion being scanty and tenacious adheres to the neighbourhood in which it is formed. It does not therefore reach the bladder and become mixed throughout the urine, but is washed out from the surface of the whole canal with the first gush of urine, and the formed fragments are found for the most part in the first glass irrespective of their place of origin. Syringing out the anterior urethra with a colourless solution, e.g., boric acid, will remove the contents of the anterior section of the canal. These washings are collected in urine glasses and inspected for the presence of filaments. The first portion of the urine will now contain specimens from the posterior urethra only.

Another method of differentiating is to distend the anterior urethra with a weak solution of methylene blue. All the shreds from the anterior urethra in the urine passed thereafter are stained blue, whilst those from the posterior urethra are unstained provided none of the stain has penetrated beyond the compressor urethræ. The use of a cold solution of the dye which excites a strong contraction of the sphincter and the avoidance of over-distension will, in the great majority of cases, ensure anterior staining only. Filaments from the posterior urethra may arise from a prostatitis rather than a urethritis. Only by the urethroscope can these conditions be differentiated with any approach to accuracy.

*The size, shape, and specific gravity of the urinary filaments*, while they afford little trustworthy evidence of the locality affected, may be considered suggestive. Long, light mucous threads, which float near the surface and take some time to sink to the bottom of the glass, are possibly derived from the urethral mucous membrane and indicate a superficial catarrh. Whereas the short, dense, and sometimes comma-shaped fragments point to glandular involvement. These heavier shreds when washed from the anterior urethra have probably been expelled from the ducts of Littré's glands; when they are derived from the posterior urethra they probably originate in the prostatic tubules. But it must be remembered that it is impossible to base a diagnosis on these appearances.

On a rare occasion a complete cast of the prostatic utricle or of one of the common seminal ducts or even of a seminal vesicle is expelled. This is most likely to occur subsequent to instrumental dilatation of the posterior urethra and lavage with nitrate of silver solution, the cast being found floating near the surface of the expelled solution.

*The phosphaturia of chronic urethritis*.—Phosphaturia is frequently observed especially in nervous, neurasthenic, or melancholic patients. It is associated with an increase in the alkaline content of the urine, and is due not necessarily to any additional phosphatic excretion, but to the production of the insoluble basic phosphates of calcium and magnesium in place of the soluble acid phosphates.

No convincing explanation of this change has as yet been advanced. It has been ascribed to deranged kidney function of a reflex nervous nature, to excessive employment of acid in gastric digestion, to

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vegetarian diet, or to the addition to the urine of alkaline secretions from the genital glands.

As it is not a feature of chronic gonorrhœa in women, two of the above hypotheses may be rejected as exclusive causes, namely, those referring to the digestion and the diet. Many American authorities favour the view that leakage of the secretion of the seminal vesicles into the posterior urethra is the responsible factor.

## CHAPTER VII

### THE TREATMENT OF CHRONIC GONOCOCCAL URETHRITIS

IN the treatment of chronic gonococcal lesions there are two main indications to be followed—(a) the destruction of the deeply-seated gonococci, and (b) the *restitutio ad integrum* of the diseased tissues. The former must be complete; the latter, while not realisable in its entirety, can in the great majority of cases be imitated with sufficient faithfulness as to be clinically satisfactory. These results can seldom be attained by any individual remedial measure. A combination of therapeutic agents is requisite in most cases, but it will seldom happen that any case, however inveterate, will fail to yield to patient treatment which is governed by a complete and definite diagnosis. Chronic infection of para-urethral passages, Cowper's glands, the prostate, seminal vesicles, and epididymes must be looked for and, if found, treated according to the rules which will be found discussed in other chapters.

The methods by which chronic gonorrhœa can be attacked include—

1. Antiseptic irrigation, lavation, and injection.
2. Dilatation.
3. Electrolysis.
4. Cauterization.
5. Incision.
6. Curetting.

7. Instillation.
8. Application of heat.
9. Ionization.
10. Medicated bougies, ointments, etc.
11. Vaccine.

Of the methods tabulated above, the first two, lavation and dilatation, have a very wide application, and are frequently used in conjunction. The next four—electrolysis, cauterization, incision, and curetting—are practised in particular conditions which are diagnosed and treated through the urethroscope.

*Lavation, irrigation, and injections.*—Urethro-vesical lavage is indicated when discharge is present in any quantity, in which case a course of this treatment is preliminary to any other local interference. The amount of discharge can always be estimated most satisfactorily by a scrutiny of the urine which has been retained for at least three hours. The finding of pus in suspension negatives the employment of any more active measures until treatment has cleared the urine. The solutions of most value are permanganate of potash, 1 : 6000–1 : 2000 ; nitrate of silver, 1 : 4000–1 : 1000 ; and oxycyanide of mercury, 1 : 10,000–1 : 4000. The method has been fully described in treating of acute urethritis. Irrigation is only adopted when using an irrigating dilator.

Astringent injections are used to hasten a prolonged declining stage or to supplement the lavage treatment. They assist in suppressing mucous and sero-mucous discharge. The sulphate of zinc (1 : 1000–1 : 500) is the most serviceable astringent. Sulphate of copper (1 : 4000–1 : 1000) is more irritating, but it is also useful, and may be combined with the zinc sulphate.

In calculating the strength of a solution for use

as an injection, it should be remembered that the longer the solution is retained in the urethra and the greater the quantity of fluid used the weaker must the concentration be. Instead of holding one syringe-ful in the urethra for the stipulated time, it is preferable to adopt the weak solutions suggested above, using several fillings of the syringe one after the other, keeping each in the canal for one minute.

It is seldom that the mere use of astringent injections will cure a case of chronic gonococcal urethritis, and if circumstances necessitate a trial of this, the simplest form of treatment, it must be superseded by more effective measures if no benefit results within a week or two. The longer resolution is delayed the more permanent are the pathological deposits which are in progress of formation, and the longer is the course of treatment which will eventually be required. The popularity of this method is not due to its intrinsic value, but to less meritorious reasons.

*Dilatation* is the most generally useful means we have at present at our command for inciting the retrogressive histological changes which tend towards restitution. Urethro-vesical lavage by the Janet method acts to some extent as a dilator, and doubtless a proportion of the beneficial effect of this mode of treatment is due to the action of the hydraulic pressure on the infiltrations. There are three different forms of instrument used for this purpose—(a) flexible bougies, the original predecessor of which was a fine wax candle, hence the name; (b) metal sounds made of plated steel or copper; (c) metal dilators capable of mechanical expansion and reclosure within the urethra.

In some schools all solid dilating instruments are called bougies, the word sound being restricted to

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stone searchers. This erroneous interpretation probably arises from the fact that the stone searcher elicits a "sound" on being tapped against a calculus, but this has no connection with the derivation of the word.

The clinical value of dilatation by sounds has long been recognised, but Oberlaender and Kollmann have greatly enlarged its usefulness and scope. Kollmann has introduced a series of dilating instruments specially designed to suit the anatomical contour of the different divisions of the urethra. These expanding dilators enable treatment to be carried

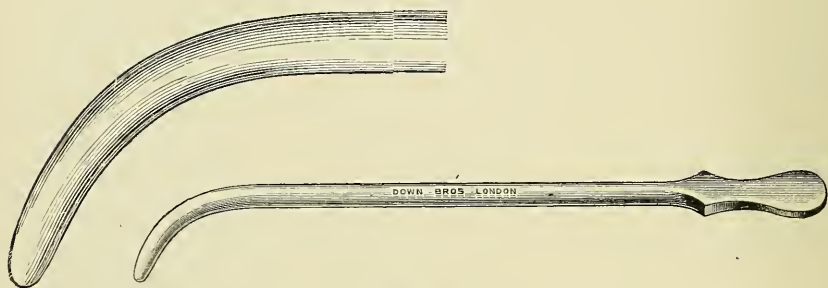


FIG. 30.  
Clutton's steel sounds.

beyond the point attainable with the largest sound capable of passing the meatus.

Dilatation, in addition to stretching constricted parts of the canal, excites changes in the infiltrated area which have a tendency the opposite of that induced by the slow continuous irritation of a chronic gonococcal infection; so that by a properly timed and graduated course of dilatation the infiltrations become absorbed, closed ducts are opened, and glands and lacunæ emptied of their contents. It is essential, therefore, that each dilatation should be followed or accompanied by urethro-vesical irrigation

to remove the expressed infective material. Instrumental dilatation affects not only infiltrations which impinge on the urethral lumen, but it also acts beneficially on the minor degrees and forms of infiltration.

The first step, however, is to determine the presence or absence of obstruction by the use of an acorn-

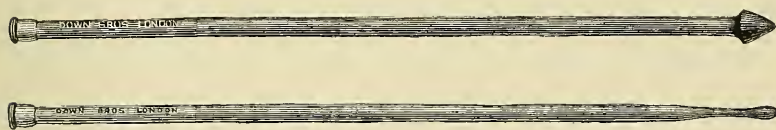


FIG. 31.  
Acorn and olivary tip bougies.

tipped flexible bougie. The results of this investigation will indicate the nature and size of the instrument next to be inserted.

The best instruments for this mode of treatment are metal sounds (Figs. 30 and 35) ; but when cicatricial changes are so far advanced in an infiltration that a stricture has resulted, it may be necessary in the first place to employ flexible bougies (Fig. 31) until the canal has been widened sufficiently to allow



FIG. 32.  
Filiform bougies.

of the passage of a sound without the use of any force. It is not advisable to attempt the passage of a metal instrument smaller than No. 10 or perhaps even No. 12 Charrière.

The utmost gentleness must be exercised in practising the insertion of instruments. The formation of

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false passages or the production of traumatism of the healthy urethral mucosa has to be guarded against. It must not be forgotten that the urethral mucosa is an exceedingly sensitive structure, comparable in this respect to the conjunctiva, and therefore requiring most delicate handling. The instrument should be inserted gently and tactfully past any obstruction. It must lie lightly in the hand, in order that the fullest delicacy of the sense of touch may be brought into play. Once the tip of the sound is successfully past the point where the infiltration is known to lie, the tapering shaft is lightly and steadily slipped through the infiltration. The healthy portion of the urethra readily distends, but the inelastic diseased area is gradually broken up. The aim is to



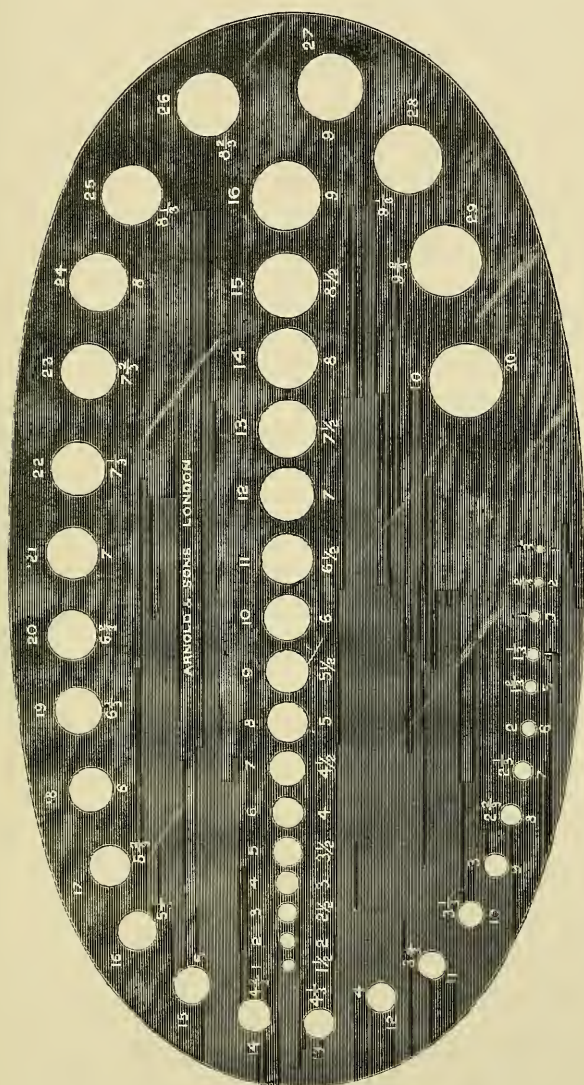
FIG. 33.

Torpedo sound for penile infiltrations.

produce a multitude of minute traumatic lesions in the infiltration, as a result of which, processes of absorption are initiated, and this effect is achieved by slow, steady, and gentle dilatation. The weight of the sound is almost sufficient in itself, and certainly neither pain nor bleeding should be produced. Macroscopic lesions only delay the progress of the cure.

In order to ensure the minimal character of the lesions in the infiltrations, it is necessary to proceed by very small gradations from the one to the next sound. For this reason sounds conforming to the English scale are unsuitable, and even the ordinary French Charrière scale, which increases by one-third of a millimetre, fails to meet all the requirements

(Fig. 34). A new scale known as the Guyon or Benique, in which the number of sounds has been



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number thirty is ten millimetres and the circumference thirty millimetres. In the Guyon scale there are six to each millimetre, and number sixty is ten millimetres thick and corresponds to number thirty Charrière. Nothing is to be gained by retaining the old English gauge; on the contrary, much confusion would be obviated by the general adoption of a universal scale. It seems unfortunate that a system of numbering different to the Charrière scale should have been suggested. The increase in the number of instruments for which there is some justification could

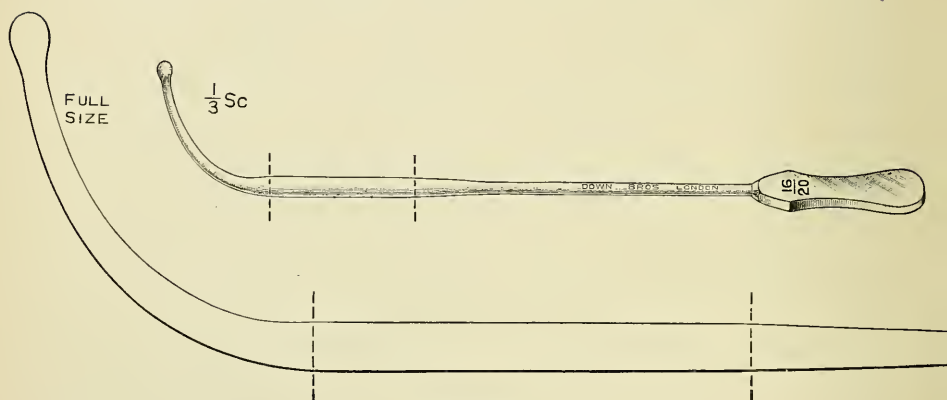


FIG. 35.  
Watson's dilating sound.

have been quite satisfactorily dealt with by the addition either of a plus sign (+) or .5 to the ordinary Charrière number for the intermediary sizes.

It is a distinct advantage for the shaft of the sound to be reduced in size proximal to the bellied dilating portion so as to free the tension on the meatus. This improvement was first suggested by J. H. Nicoll. It prevents the possibility of friction at the meatus obscuring the actual urethral condition.

When sounds of the Guyon measurements are

employed three instruments may be passed at each visit. If English or Charrière sounds are used only two should be tried at one treatment, beginning with the largest size used at the previous consultation. There is little or no advantage to be obtained by leaving the sound *in situ* for any length of time; the longer it is retained the firmer will be the grip of the urethra on the instrument. Relaxation such as is aimed at in the continuous method of dilatation does not make its first appearance for several hours.

The sound which is illustrated above (Fig. 35) was made for me by Messrs. Down Bros. Its features

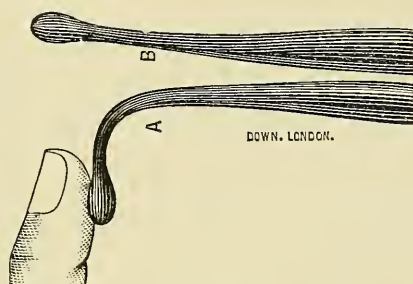


FIG. 36.  
Olivary-tip bougies.

are: (1) Each instrument has a round ball point; the usual sharper oval point of a Lister sound tends to become caught at any obstructing point, and, even in the healthy urethra, the cul-de-sac which often exists at the extremity of the bulbous portion of the urethra presents a difficulty. (2) The curve is shorter and more acute than in the common English pattern. This facilitates its entrance into the posterior urethra. (3) Each sound tapers to the extent of four numbers of the Charrière scale. The expansion begins three centimetres from the ball tip, reaches its maximum in other three centimetres, and retains the maximum for six centimetres, beyond

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which the diameter is gradually reduced, leaving a narrow shaft, which is not gripped by the meatus. When fully introduced into the urethra, the enlarged portion of the sound lies in the posterior urethra with only the ball point and short curve in the bladder. These instruments are thus equally useful for the anterior or posterior urethra, but straight sounds on similar principles are made for the anterior urethra (Fig. 37). The smallest size which I use is 10-14, and the largest 26-30 (Charrière), the set comprising sixteen instruments. For strictures requiring smaller instruments than 10-14, flexible

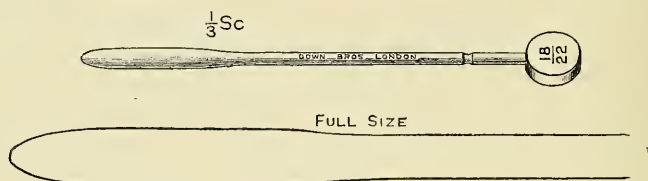


FIG. 37.

Watson's straight anterior dilating sound.

olivary bougies should be used until sufficient dilatation has been achieved to allow of the easy and safe introduction of the metal sound.

Dilatation may be repeated as a rule every three days, but when a marked reaction follows a treatment, or when bleeding results at the time, the interval is extended. Bleeding in chronic cases is usually due to a longitudinal tear, and whenever this is noticed dilatation should be stopped immediately and not repeated for ten days. If the bleeding is troublesome, there is no objection to the injection of a small quantity of adrenalin. When, on using a smaller sound after an interval sufficient to allow of healing, bleeding recurs, a careful urethroscopic search may be made to exclude erosions or papillomatous growths.

It has already been remarked that dilatation is

always accompanied by flushing the urinary tract. This may be accomplished by filling the bladder previous to the passage of the sound and discharging the contents after the operation of dilating, or the bladder may be both filled and emptied after the dilatation. The solutions of most service for the former method are 1 : 4000 oxycyanide of mercury and concentrated boric acid. Oxycyanide of mercury should be avoided if the patient has recently been dosed with potassium iodide. The iodide of mercury which forms in the bladder in such cases is very irritating to the mucous membrane and produces cystitis. Permanganate may be used for lavage after dilatation, but it must not be instilled into the bladder before passing the sound on account of its contractile effect on the mucous membrane, which would greatly impede the insertion of the instrument. Silver nitrate (1 : 10,000–1 : 4000) is particularly useful in combination with dilatation. A good result can often be got from its use when other agents are slow or ineffective. In addition to its astringent and antiseptic action, it excites a marked contraction of the musculature of the urethra and its adnexa as well as of the bladder, and thus facilitates emptying of distended follicles and ducts. One of the organic silver compounds may be employed in the same way.

*Meatotomy.*—Section of the meatus is sometimes necessary before dilatation treatment can be completed. In some cases a close examination of the meatus will show the presence of transverse adhesions, the snipping of which will considerably enlarge the aperture. In other cases the encroachment is purely membranous, and this may require incision at both angles. As a rule, however, what is required is incision of the lower angle of the meatus.

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The angle of the wound and each side may receive a stitch of fine catgut to control bleeding and prevent reunion.

*Kollmann's dilators* (Fig. 38) are of great value when the sounds have reached the limit of their usefulness and further treatment is still required. The meatus, the narrowest part of the canal, obstructs the admission of sounds of sufficient calibre to produce the maximum beneficial effects of dilatation. Kollmann's dilators are therefore designed so that they will pass an ordinary meatus without difficulty,

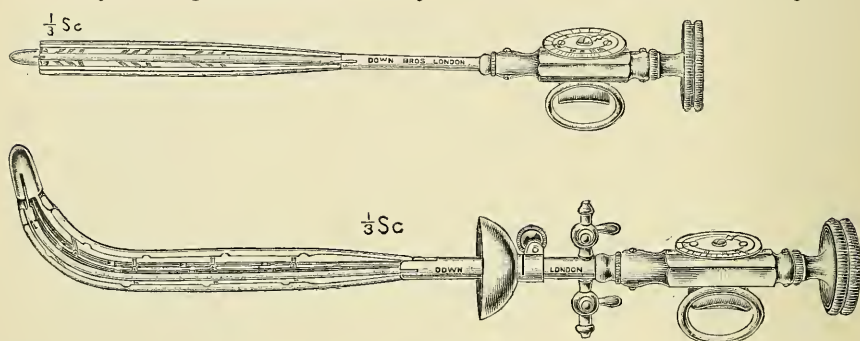


FIG. 38.  
Kollmann's dilators.

and thereafter they can be expanded to any desirable extent without interfering with the width at the meatus, and they are again collapsed before withdrawal. Various instruments are supplied suitable for different regions. For the anterior urethra a straight dilator is used, and for the posterior urethra one with a suitable curve. It is necessary to be furnished with both, although the former is more frequently required. The form which is applicable to the entire urethra can very rarely be the proper instrument to use. In each case an irrigating attachment is an advantage, but, as mentioned above, permanganate solution must not be adopted as the

cleansing fluid, otherwise difficulty would be experienced in withdrawing the instrument, which would be found tightly gripped by the urethra.

These dilators should not be used more frequently than twice in one week. Four or five day intervals are preferable. The onset of bleeding is an indication for at least a fortnight's rest.

The index-dial attached to the instrument shows the amount of dilatation which the rotation of the screw-handle has achieved. All that has been said with reference to the need for care and gentleness in the use of the sound applies with equal force in the case of Kollmann's dilators. The site of the infiltration must be accurately located, the appropriate instrument chosen, and the increase in the amount of dilatation attempted must be carefully controlled, never exceeding two or at the most three numbers above the former application.

While the improvement in the condition of the parts as shown by the decrease in the quantity of gleet discharge and in the number of urinary filaments will encourage both the patient and the medical attendant to persevere, it is wise in all cases to have recourse periodically to urethroscopic examination for corroboration.

Three suppositories of atropine sulphate (1/75 grain) should be used in connection with each instrumental interference to abolish the tendency to reflex peristalsis along the ejaculatory ducts and thus eliminate the risk of exciting epididymitis. A suppository is inserted into the rectum the night and morning before the dilatation and one the night following. On the same occasions 10 grains of hexamethylenamin may be prescribed.

*Electrolysis, cauterization, incision, and curetting* are

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only possible under the conditions which make urethroscopy justifiable—that is to say, there must be no acute inflammation, and the urethra must be sufficiently dilatable to admit the endoscope tube without pain or hæmorrhage.

*Electrolysis* is the most useful and thorough means we possess for the destruction of chronically diseased follicles, crypts, para-urethral passages, etc., which may survive lavage and dilatation. The amount of tissue destruction is easily controlled, and can thus be limited to pathological structures. It is unwise to treat more than three or four spots at one sitting, and

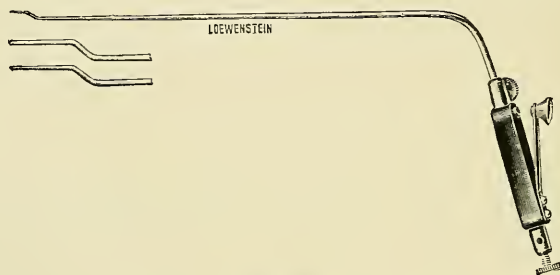


FIG. 39.  
Electrolysis needles and holder.

these should not be close together, so that in case of over-treatment the resulting cicatrices would not coalesce. The discrete point cicatrices which follow careful application of the electrolytic needle are entirely harmless.

The apparatus which is necessary consists of a special holder and needle for urethroscopic work (Fig. 39), a battery or accumulator of at least four volts with a crank collector or other arrangement for regulating the strength of the current, a milliamperemeter, and flexible connection cords. The positive electrode, usually a zinc plate with a moistened sponge attached, may be strapped to the patient's thigh or

arm, while the negative pole is connected with the needle-holder. A current of three milliamperes should not be exceeded, and the duration of the exposure should be limited to about sixty seconds. The point of the needle can be bent into such form as will enable it to penetrate as far as is desired into the duct.

That the electrolysis is proceeding satisfactorily, after the needle has been inserted the desired depth into the follicle, is evidenced by the appearance of minute bubbles of froth escaping alongside the needle. A little practice with hair follicles on their own skin is advisable for beginners, and will enable them to estimate approximately the amount of reaction to be expected from currents of different strengths and durations.

Electrolysis is the cleanliest and surest method of destroying scattered foci of infection when such have been discovered through the urethroscope. There is no difficulty in permanently removing any offending gland or crypt by this means, and the resulting scar, unless the treatment has been unnecessarily excessive, is negligible. Over-treatment, especially of a number of closely aggregated follicles, would, however, lead to more or less stricture, and this, of course, must be avoided. In some cases destruction of the gland is not indicated, and electrolysis treatment which stops short of scar formation might suffice to eliminate the gonococci and lead to cure.

*Cauterization* may be achieved by means of (a) the electric cautery, several forms of which are made for urethral work; (b) the application of solid nitrate of silver fused on to the end of a urethral probe; (c) touching with strong caustic solutions.

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*The galvano-cautery* performs much the same function as the electrolytic needle in the destruction of granulations, polypi, and warts. Polypi frequently occur in the posterior urethra in the region of the verumontanum, and once an assured diagnosis has been made they may be destroyed by the cautery. Warts seldom require the use of the cautery, as they can usually be made to disappear by injections of lactic acid (1 in 200) or direct applications of a swab of the pure acid. For intractable papillomata, recourse may be had to the electric cautery. A special battery is used for cautery work, as a high amperage combined with low voltage are requisite. A rheostat is attached to regulate the current, and special cautery cords are also needed.

In employing the cautery the urethroscope is tilted in such direction as will bring the growth well into the end of the tube. The field is thoroughly dried, the cold cautery is introduced, and the connection made and maintained until the base of the polypus is destroyed. Several applications with intervening inspections may be required. Care must be taken not to embed the cautery in the tissue, otherwise hæmorrhage will follow its withdrawal. The pressure used must therefore be of the lightest.

The disadvantages of the galvano-cautery are the production of smoke which obscures the view, the liability to hæmorrhage, the danger of septic infection of the burned area, and the risk of over-treatment producing obstructive cicatrices.

Cauterization by silver nitrate is only suitable for small areas, and only one side of the urethra should be attacked to obviate the production of strictures. Longitudinal scars may be of little consequence, but most unhappy effects are certain to follow if a circular cicatrix is encouraged.

## CHRONIC GONOCOCCAL URETHRITIS 143

Topical applications of strong solutions of silver nitrate (10 per cent) serve most of the purposes of chemical cauterization. Solutions can be applied on swabs, care being taken to avoid healthy mucous membrane, but greater precision is secured by the use of a fine camel-hair brush concealed in a narrow tube. When the tube reaches the spot to be treated the brush is projected from its container by means

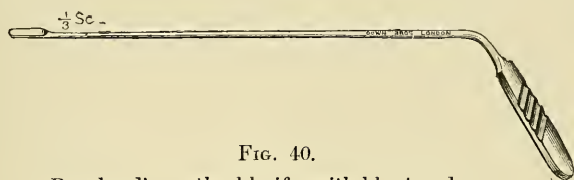


FIG. 40.

Burghard's urethral knife, with blunt end.

of a spring. Tincture of iodine used in this manner is often of service. Salicylic acid is also used, especially for keratinized spots. In the posterior urethra, applications of silver nitrate solution or of tincture of iodine by the brush to a hypertrophied and congested verumontanum are frequently of great benefit.

Solutions can also be injected into the sinus pocularis or into the gaping orifice of any diseased gland by means of a special canula to which a small syringe can be attached.

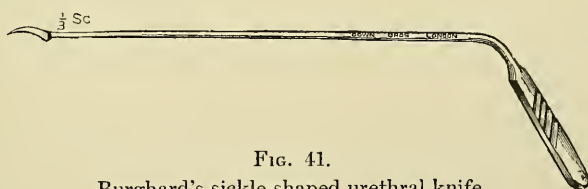


FIG. 41.

Burghard's sickle-shaped urethral knife.

*Incision* is indicated when any small abscess is detected through the urethroscope. Fibrous bands and undilatable strictures may also be divided with the help of the urethroscope.

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*Curettage* is of most use for granulations and small growths. It may be followed by the application of caustic solutions.

Endourethral scissors, forceps, punch and aspirating pipette are also useful instruments for individual cases.

*Instillations.*—By instillation is meant the injection of from one to twenty drops of a strong medicament into one region of the urethra where the disease is localised. This method is employed principally for the prostatic urethra, and either the Guyon or Ultzmann syringe (Figs. 43 and 44) may be used.

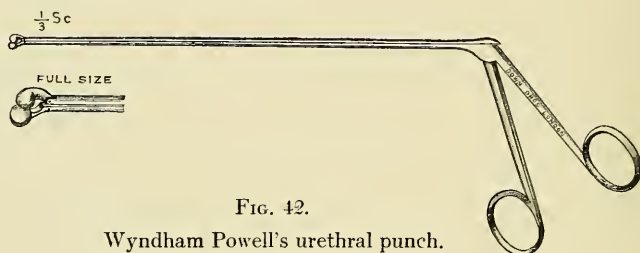


FIG. 42.

Wyndham Powell's urethral punch.

Nitrate of silver solution, 2 per cent to 5 per cent, is adopted more frequently than any other for this purpose. This procedure is now much less frequently employed than formerly, being displaced by the more precise and less dangerous methods applicable through the endoscopic tube. One or two injections of a few drops of the weaker solution are, however, quite justifiable, and they will be found to act beneficially in some cases. The class of case for which they are suited is that in which there is a superficial epithelial catarrh remaining indefinitely after the gonococcal inflammation has subsided and when infiltrations are in process of formation.

*Thermo-therapy.* — The observation that most strains of gonococci are killed by comparatively low

temperatures (40° C. in six hours) led to many attempts to utilise heat in the treatment of gonorrhœa. The published results so far have been conflicting. While the surface temperature of the urethral mucosa can easily be raised, it is difficult to have sufficient effect on the underlying vascular tissues with

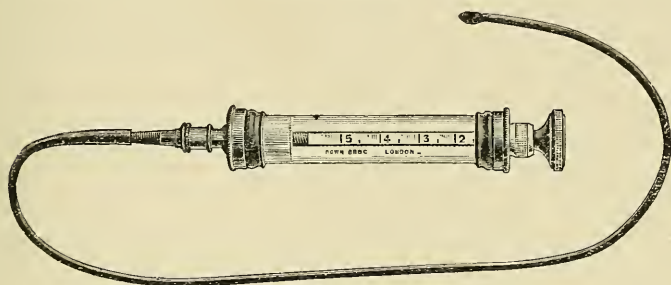


FIG. 43.  
Guyon's syringe.

their rapidly circulating blood stream. It is conceivable that as a method of aborting gonorrhœa thermal treatment might be successful, provided the infection was limited to the pendulous urethra. A ligature should be applied to the root of the penis, while an electrical bougie inserted into the pendulous urethra is retained in position for thirty minutes at



FIG. 44.  
Ultzmann's syringe.

the maximum bearable temperature (45° to 48° C.). Whatever the final conclusion may be regarding the practicability of the heat treatment for acute gonorrhœa, it is now accepted as being of distinct value in certain chronic conditions, particularly infiltrations and prostatitis.

There are two modes in which the treatment can

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be applied—(a) hollow double-channel sounds for the circulation of hot water, and (b) electrically-heated bougies. The thermo-penetration is more rapid and complete with the latter instruments, but they require more care and experience in their handling. One hour of the hot-water circulation corresponds to a quarter of an hour with the electric bougies.

*Hot-water sounds.*—(Fig. 45.) The inlet is connected with a reservoir placed eighteen inches above the recumbent patient, and containing water at  $46^{\circ}\text{C}$ . The exit tube empties into a bucket. The sound is passed into the bladder and the water allowed to circulate. By the addition of hot water to the irrigator the tempera-

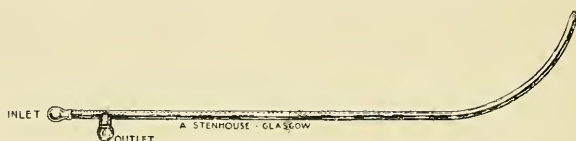


FIG. 45.

Hot-water sound.

ture is gradually raised to  $52^{\circ}\text{C}$ ., and it is kept at this heat until the end of the operation (thirty to sixty minutes).

The size of instrument used must be one which will pass readily, and no cocaine should be employed to obliterate the natural feeling of the urethra and abolish an important safeguard against overheating. In a few minutes the warmth establishes a feeling of comfort, and if the right temperature is being used no pain should be complained of. The urethral mucosa is not, of course, raised in temperature to an equality with the circulating water. There is probably a difference of about  $10^{\circ}\text{C}$ .

*The Kobelt electrically-heated bougies* are the best pattern on the market. Both flexible and metal

instruments can be obtained. They are heated by the insertion in the interior of the instrument of a resistance coil. A control thermometer in the circuit indicates the heat of the instrument. The current is supplied by an ordinary accumulator with rheostat. An automatic closure of the current prevents too high a temperature being registered.

*Technique.*—The temperature of the lubricated bougie is raised to 37° C., and it is introduced into the urethra with aseptic precautions. The temperature is gradually raised to 50°–55° C. Higher degrees are painful. Each bougie is retained in the urethra for ten minutes, when it is withdrawn and the next size inserted. Three sizes are used at each seance, which therefore lasts thirty minutes.

The result of this treatment is an active hyperæmia, and the appearance at the meatus alongside the bougie of some sero-mucous exudation.

It is maintained by Scharf, Kobelt, Fulton, and others that absorption of infiltrations is attained more quickly and painlessly by the heat method than by simple dilation with sounds.

It has been found that when a stricture is impassable to the smallest bougie, the insertion of the warm instrument as near as possible to the stricture for ten minutes or more will cause it to dilate sufficiently to enable a bougie to pass.

The treatment is repeated two or three times a week unless contra-indicated by the occurrence of bleeding or excessive reaction.

*Ionization.*—The principle of “ionic medication” has been applied in chronic urethral infection in the hope of reaching the tissue-embedded organisms. Zinc and silver have been tried. In using the former, the

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urethral electrode (Fig. 46) is essentially a gum-elastic catheter minus the bladder eyelet, but with many lateral perforations on its walls and a central zinc stylet. The outer end of the catheter should be cone-shaped so as to plug the urethra, and the end of the stylet should fit snugly into the catheter and close its aperture. With the catheter in the urethra, sulphate of zinc solution ( $\frac{1}{4}$  per cent) is injected. The zinc stylet is inserted and connected with the positive pole of a constant battery.

The kathode is applied to the patient's thigh or other convenient position, and a current of five milli-

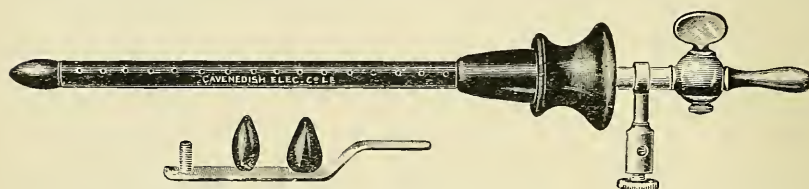


FIG. 46.

Pollmann's electrode for urethra.

amperes turned on for five minutes. The effect in most cases is to excite a purulent discharge which disappears in a few days, and the condition is then found somewhat improved.

Better results are reported by Luys with silver ions. After urethro-vesical lavage with boric acid solution, a silver sound is passed—a straight one for the anterior, or a curved one for the posterior urethra. The current is continued for ten or fifteen minutes, and then reversed for a few minutes before extracting the sound. If removal of the sound is attempted without changing the direction of the current the sound will be found firmly adherent to the urethral walls.

## MEDICATED BOUGIES, OINTMENTS, ETC.

*Medicated bougies* are disappointing in their remedial effects, and are, on the other hand, a frequent cause of irritation. If a bougie is inserted into the anterior urethra at night the remnants may find their way into the posterior urethra, thence to the bladder, with a consequent cystitis or epididymitis.

*Ointments* are only of use for the purpose of protecting an eroded or excoriated surface from contact with the urine. There are several types of urethral ointment introducers. Any antigonococcal medicament may be combined with a lanoline base. The addition of glycerine or oil renders the ointment more fluid.

*Schindler's agar jelly*.—For early chronic or late subacute cases Schindler recommends the injection of an agar jelly with  $\frac{1}{2}$  per cent protargol incorporated. His prescription is—

R Agar jelly (2.5 per cent)	40
Dissolve with gentle heat and add dis-	
tilled water	160
When cold sprinkle on the surface pro-	
targol	1
Allow to stand some hours, then mix thoroughly	
with a glass rod.	

This jelly is sufficiently thin to be injected with a small urethral syringe. Harrison and Harold recommend that this injection should be expelled by urination in ten or fifteen minutes. It has a marked gonococcicidal effect, but if retained too long it may irritate unduly. The reaction must then be

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controlled either by reducing the percentage of protargol or the duration of the retention period. Its consistence ensures that a proportion remains in contact with the urethral mucosa until the next urination.

## CHAPTER VIII

### THE URETHROSCOPE IN THE DIAGNOSIS AND TREATMENT OF CHRONIC URETHRITIS

A COMPLETE comprehension of the various infective conditions which are productive of a chronic urethral irritation and discharge is impossible without recourse to endoscopic examination of the urethra. Through the urethroscope as now perfected, the whole surface of the urethral mucosa, both anterior and posterior, with its communicating orifices, can be inspected, and pathological conditions can be treated under the direct control of the eye.

The insertion of an urethroscope, like all other instrumentation, is inadmissible in acute conditions, but the urethroscope plays an invaluable rôle in cases of delayed resolution and in cases where ordinary treatment fails to completely cure the infection and remove all traces of discharge—that is to say, in prolonged subacute and in chronic conditions. In these cases the requisite treatment can only be determined upon after an exact diagnosis of the particular lesion which is responsible for the continuance of the symptoms. In many cases accuracy is obtainable only by the use of the urethroscope, and in some cases the necessary treatment can only be effected through the urethroscopic tube. The urethroscope is as indispensable to the urologist as the laryngoscope or ophthalmoscope to the respective specialists. A

familiarity with the instrument and the normal and abnormal appearances which can be viewed with its assistance is therefore essential to all practitioners of urology.

*History of the urethroscope.*—The desirability of endoscopic inspection of the urethra prompted several early attempts to illuminate the urethra, but the primitive lighting methods then available rendered these interesting efforts abortive. Desormeux (1853) is responsible for the first practical instrument, and his treatise on endoscopy of the urethra stimulated a succeeding generation to improve on his methods. The first urethroscope consisted of funnel-shaped urethral tubes or specula into which sunlight or artificial light was reflected by mirrors. The advent of electric light gave a fresh impetus to urethroscopy, and enabled it to take an important place in clinical work. Nitze, in 1877, introduced a novel method of lighting. Inside the urethroscopic tube he placed a small brass tube containing a platinum wire which projected a short distance beyond its container. An electric current passing along the platinum and returning by the brass heated the platinum to a red glow which illuminated the interior of the urethra. This apparatus had to be kept cool by circulating water. The use of a minute electric cold lamp suggested by Drs. Kock and Preston, of Rochester, and adopted by Valentine in 1903, has made internal lighting of real practical utility.

The instruments now employed for the anterior urethra fall into two classes : —

- (a) Those in which the light is reflected from an external electric lamp, and focussed at the end of the urethroscopic tube;
- (b) those in which the light is obtained from a

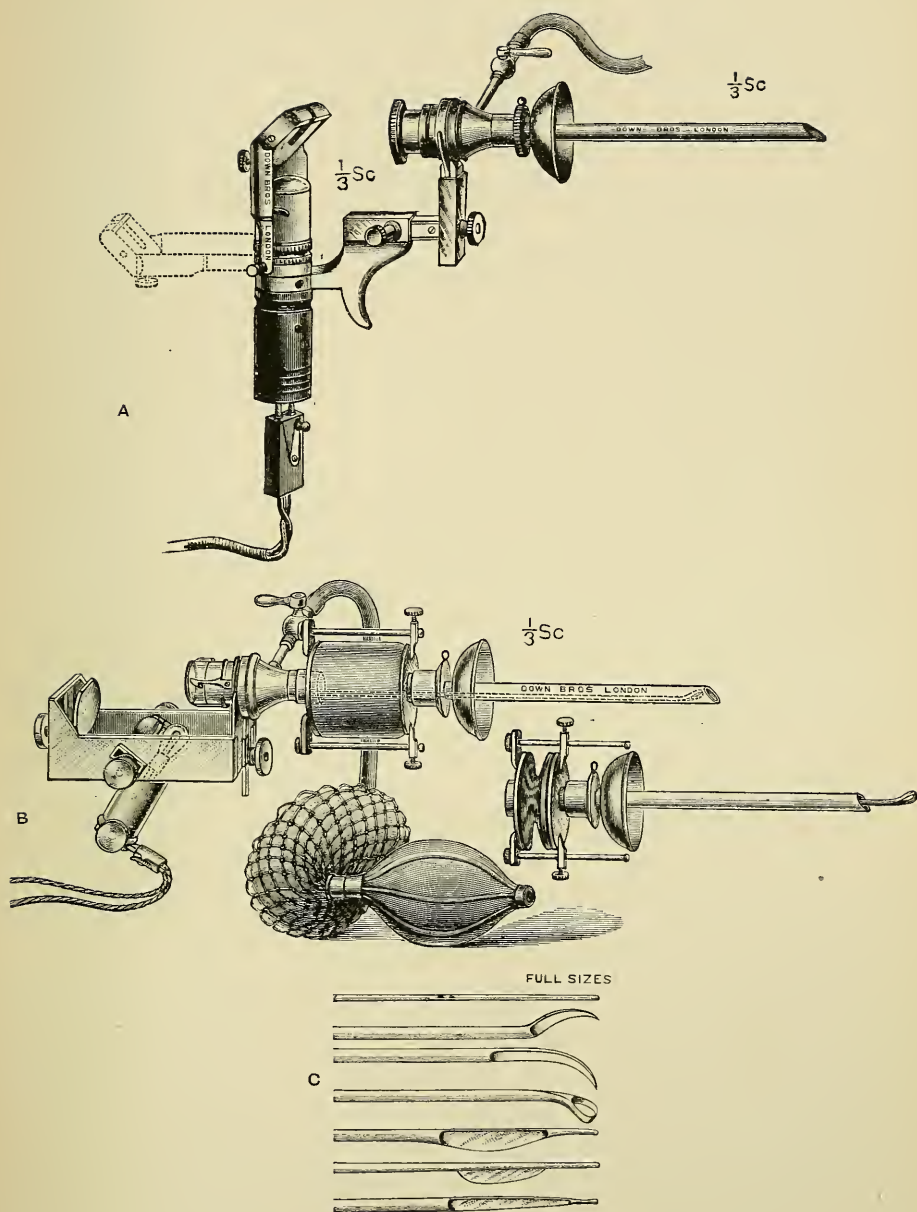


FIG. 47.

- A. Wyndham Powell's aero-urethroscope.
- B. Do. do. with operating attachment.
- C. Instruments for use with B.

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minute lamp fixed near the internal end of the urethroscopic tube.

It will be necessary to give a short description of a recent model of each of these types.

Perhaps the best example of the externally illuminated urethroscope is the instrument designed by Wyndham Powell (Fig. 47). In this urethroscope the urethral tube is fitted with a protecting cup, which fits over the glans, and each tube has a neck of uniform size into which the nozzle carrying the lens is inserted after the obturator has been removed. The lamp when in position is at right angles to the tube, and the light is reflected by a movable mirror placed above the lamp. A sliding cross-bar connects the lamp and handle with the upright supporting the lens. From the nozzle of the lens portion projects a narrow tube with stopcock to which a rubber bellows can be attached for inflating the urethra. The use of a telescope ensures a clear view of the distended anterior urethra. For the purpose of operating on the inflated urethra a collapsable rubber drum can be inserted between the lens nozzle and the urethroscopic tube. The probe or knife which it is desired to introduce into the urethra is fixed into a female screw inside the collapsable mechanism. The urethroscope thus becomes the handle of the probe. By screwing up the rubber drum the probe is made to project beyond the urethral tube, and on tilting the urethroscope in the desired direction the mucous membrane can be probed, cauterized, or cut. In addition to knives and probe, a curette, electrolytic needle, or a fine syringe can be employed in a similar manner. For electrolysis, as the rubber mount is already insulated, all that is necessary is to fix the negative wire to the metal part of the urethroscope,

the other pole being placed on the patient's thigh. A three-filament lamp is used, and a current up to eight volts is required. The power can be obtained either from an accumulator or from the main with the interposition of a suitable rheostat.

Much useful treatment can be carried out without the aero-dilating fitment by removing the lens after locating the point to be attacked and approaching it through the open lighted tube.

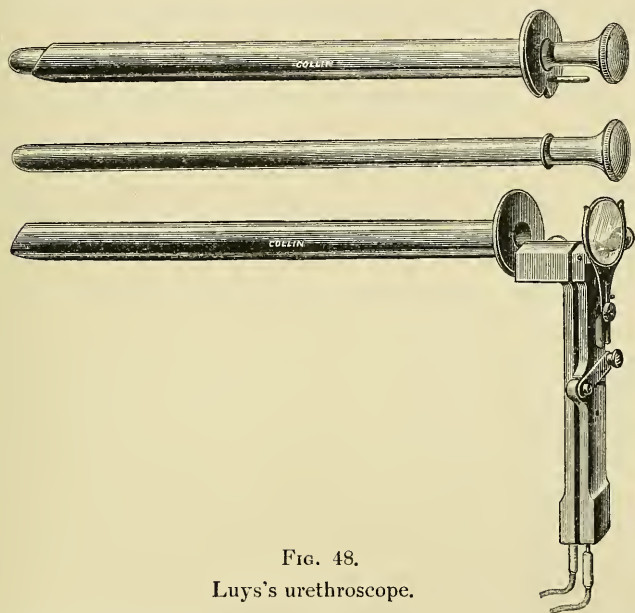


FIG. 48.  
Luys's urethroscope.

As a representative of the second type of urethroscope, that with the internal lamp, we may take the instrument of Valentine as improved by Luys of Paris (Fig. 48). This urethroscope consists of two portions—(a) the urethroscopic tube with its obturator, (b) the electric fitting. The tubes vary in length according to the part of the urethra to be explored, and in diameter according to the capacity of the meatus. For the penile urethra a tube seven centimetres long is provided. For the posterior urethra

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the tubes measure fourteen centimetres. The medium tubes, which are those most frequently useful, are thirteen centimetres in length, and they allow the whole urethra anterior to be examined.

The diameter which the average urethra can accommodate with comfort is about equal to number twenty-six on the French scale, but on account of the larger field of observation the largest admissible tube should be employed.

The tubes are not perfectly cylindrical. A groove for the reception of the lighting rod runs along the bottom of the tube. The sinking of the lamp carrier is a distinct improvement on the original Valentine model, giving as it does an unobstructed approach to the urethral mucosa. The tubes and obturator are made of plated metal, and they can therefore be boiled without damage.

The electric fitting comprises a metal plate with a switch, and it is bored at the lower end with two apertures for the poles of the battery, and near the upper end with two holes, one for the reception at a right angle of the lamp carrier, and the other for a corresponding peg on the urethroscopic tube. The plate acts as a handle, and carries at its upper part a removable magnifying lens. The length of the lamp holder is such as to bring the lamp as near to the end of the tube as possible without touching the mucous membrane.

The electrical portion can be sterilised by formaline vapour. The lamps are easily interchangeable, and several should be kept in stock. They give off very little heat when comparatively new, but they should not be too long in use. There is no need to fear any ill-effects from overheating of the lamp. After two or three minutes' burning it

registers at the most a temperature of  $41^{\circ}$ – $43^{\circ}$  C. A one-volt dry cell gives sufficient current for these small lamps.

Perfect illumination and an unimpeded view is obtained with this easily-handled and simple instrument. The lightness and portability of the apparatus are greatly in its favour. It can be fitted with aerodilating connections, but Luys does not specially recommend this addition.

Gordon, of Vancouver, has designed a very interesting urethroscope (Fig. 49), which is particularly suited for operative work within the urethra, while the canal is dilated with air. Like the Valentine instrument, it is internally lit. It is furnished with two changeable magnifying windows, one for diagnostic purposes and the other with an opening for instruments.

“The comparative disadvantages of the ordinary non-dilating urethroscope are that it allows of a view of a somewhat limited area of the urethra at one time as the mucous membrane rosettes into an open end, and since the non-dilating instrument has first to be introduced to the triangular ligament, all pus beads marking the orifices of the crypts of Morgagni, etc., are displaced. Moreover, operating on the cushion-like folds of the undistended urethra is most difficult.

Hence many attempts have been made to devise a practicable dilating urethroscope, the great difficulty having been to design one that would give the right degree of distension, a good light, large field, and direct view, while leaving the operator's hands free. The distension is given, according to Dr. Gordon's practice, by the patient himself by pressure on the dilating bulb when asked. The lamp is at the distal end, out of the line of sight, being passed in on a light carrier through our auxiliary tube, gives no back reflections into the main tube and cannot be

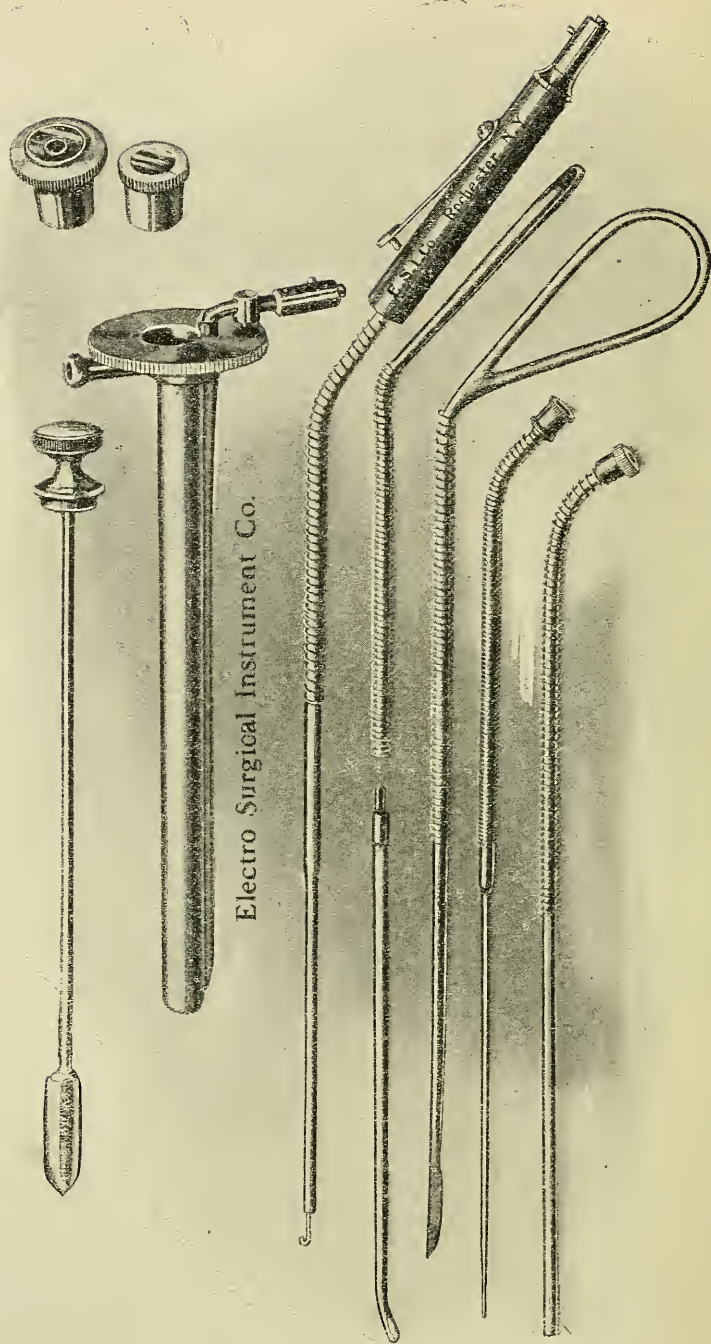


FIG. 49. G. S. Gordon dilating urethroscope.

broken by instruments passed into the tube. A marked improvement has recently been made in the lighting of this instrument whereby the auxiliary tube for the light carrier has been carried out to the very end of the main tube and left entirely open at its distal extremity, so that the light shines forward, brilliantly illuminating the dilated urethra. To fill the end opening of the auxiliary tube during introduction the obturator has been provided with a movable lug on a spring.

After introduction into the urethra just beyond the fossa navicularis, the obturator is withdrawn and the magnifying window inserted. The patient is then asked to press the bulb, dilation of the urethra follows, the tube is gradually advanced until the sphincter of the bladder is reached—and the whole passage has been examined with a minimum of discomfort.

The operating instruments are—

1. An electro-cautery for warts.
2. A curette for papillomata and pedunculated warts, the end of the urethroscope being laid against the base of the tumor, the curette advanced beyond it and withdrawn so as to catch the tumor between the curette and the edge of the tube.
3. A probe-pointed knife.
4. A syringe for injecting the crypts of Morgagni.
5. A carrier for a filiform bougie.

The spiral spring on the shank of each instrument prevents it from dropping beyond the tube before required for operation. Two magnifying windows are furnished, one for observation, and the other, perforated, for use with operating instruments. The Gordon urethroscope is 13 centimetres long and 25, French, in calibre."

An externally lit operating urethroscope with several novel features has recently been devised by Joly ("Lancet," 10/1/1914). A rubber fitment

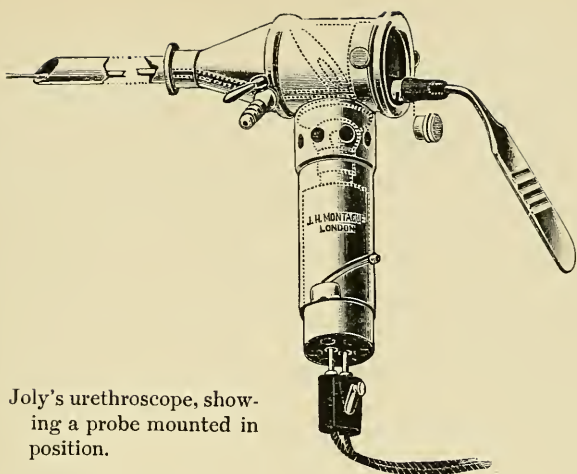
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allows the insertion and manipulation of instruments through an opening in the lower margin of the window. The illustrations (Fig. 50) sufficiently denote the mechanism.

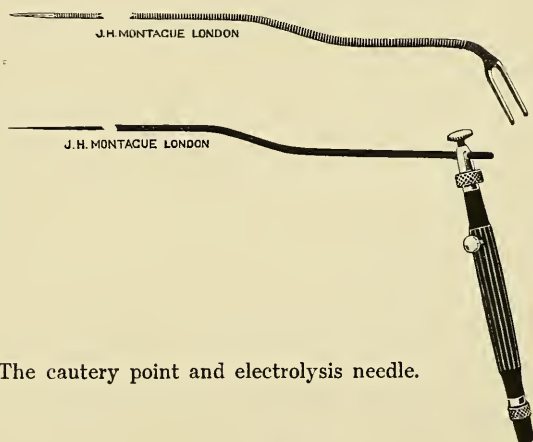
*Urethrosopes for the posterior urethra.*—External lighting is not satisfactory for examination of the posterior urethra. It is difficult to get a sufficient illumination reflected the necessary distance down the lengthened tube. The delicate structures in the posterior urethra are some distance from the eye, and yet they require to be minutely examined. Magnification and good lighting are therefore essential, and this can only be obtained by means of an internal lamp and an accessory optical tube.

Luys uses and recommends the urethroscope which he employs for the anterior urethra, the only difference being the substitution of a longer (14 centimetres) urethral tube. For some particular purposes this tube is useful, and when special skill in its manipulation has been acquired it may, as in Luys's hands, prove satisfactory. But there are several objections to the general use of this type of instrument for the posterior urethra. The introduction of a straight tube is attended with some difficulty, and is liable to injure the sensitive structures in the posterior urethra, especially when these are inflamed. Bleeding may ensue and be difficult to control, preventing any examination at that sitting. Again, it cannot be pushed far into the prostatic urethra, otherwise it may tap the bladder with a consequent escape of urine into the tube. The use of an elbowed obturator greatly facilitates the introduction of a straight tube.

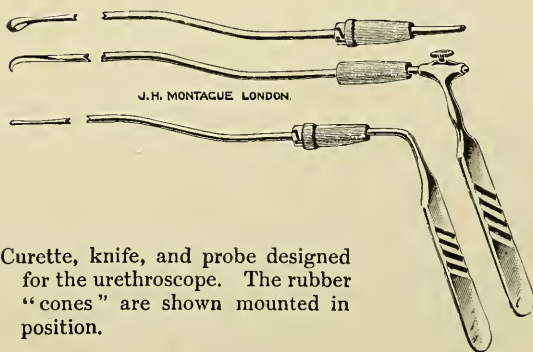
The best form of instrument, however, for posterior urethroscopy carries its light in the distal end of a closed and elbowed tube with an aperture through



Joly's urethroscope, showing a probe mounted in position.



The cautery point and electrolysis needle.



Curette, knife, and probe designed for the urethroscope. The rubber "cones" are shown mounted in position.

FIG. 50

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which the mucosa is inspected. Such an instrument may be fitted with an air or water dilating attachment, and also with a telescope.

There are three urethroscopes, all of which are good.

*Goldschmidt's* is a water dilating urethroscope, and is built on the principle of the irrigating cystoscope. The water flows from an irrigator into the posterior urethra, which it dilates and then overflows into the bladder. The whole floor of the posterior urethra can be examined, and the various objects, being magnified and well lit, can be studied in detail. The upper wall of the urethra is, however, not within the field of vision.

*Buerger's cysto-urethroscope* contains some improvements on the above pattern. The bladder as well as the whole surface of the posterior urethra can be inspected by this instrument.

The objection to water-circulating urethroscopes is that the pressure of the water alters the appearance of the parts, rendering the mucosa of a universal paleness, so that one of the main diagnostic appearances is lost.

*The Wossidlo urethroscope* (Fig. 51) is so constructed that the posterior urethra can be lightly distended with a small quantity of air if desired, but a very satisfactory examination is possible without the air distension. It is perhaps better to dispense with the air distension, as some air might escape into the bladder, and this is objectionable. The elbowed end-piece is removable, and two are supplied, which allows of the window being on either the upper or under surface of the tube, according to whether the roof or the floor of the urethra is to be explored.

Once the technique of the above instruments has

been mastered, almost equally good results will be obtained from the use of any of them; but two instruments, one either Joly's or Luys's for the anterior urethra, and one of these above described for the posterior urethra (preferably the Wossidlo), are necessary for a complete outfit.

*The insertion of the urethroscope.*—The urethroscope should not be inserted without a preliminary exploration of the patient's urethra and an examination of the urine. It is not, therefore, employed at the first

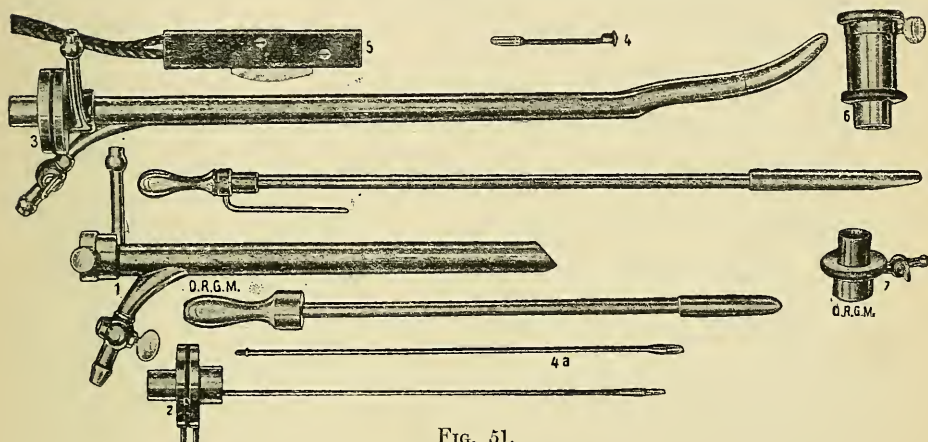


FIG. 51.

The Wossidlo urethroscope.

consultation. On this occasion the surgeon satisfies himself of the absence of any acute inflammation of the urethra, prostate, bladder, or epididymes; and finally of the absence of any stenosis of the meatus or stricture of the urethra by the use of the acorn bougie. If necessary, the urethra is subjected to dilatation treatment before the urethroscopic examination is attempted.

On the day fixed for the examination the patient should not pass urine for some hours previous to the appointment, as the pathological conditions are then

seen in a more pronounced form. The patient lies with the pelvis reaching the end of the couch or table, and with the legs separated and supported on foot rests or leg supports. The position is identical with that for cystoscopy. The glans and meatus are cleansed, and the urethral tube lubricated with sterile glycerine and with the obturator in position is inserted its full length. The obturator is then withdrawn and the urethra cleared of secretion by the use of fine wool-wrapped probes. The lighting connections are then made and the urethra examined from behind forwards by the gradual withdrawal of the urethroscope. When finished the patient cleanses the urethra by passing urine. It is advisable to prescribe a urinary antiseptic for a day or two before and after the examination, and also rectal suppositories of atropine. Local anæsthetics are seldom required in cases suitable for urethroscopy, but when a particularly nervous patient or a specially tender mucosa requires desensitisation, alypin 2 per cent should be used instead of cocaine or betaeucaine. Contact with cocaine renders the mucous membrane anæmic, while betaeucaine tends to produce a flushing of the mucosa, and pathological conditions are in either case obscured.

*The appearance of the normal anterior urethra as seen through the urethroscope.*—In the resting state the walls of the urethra are in apposition, and are thrown into longitudinal folds. On looking through the urethroscope it is seen that the urethra distended by the endoscopic tube resumes its normal collapsed condition at a point beyond the end of the instrument where the stretching effect is lost. It is this area of mucosa between the closing urethral lumen, “the central figure,” and the edge of the tube which has

to be examined with special reference to its colour, lustre, duplicature, and striation.

*The longitudinal folds* are separated by lines of increasing depth converging towards the central figure. There are normally four to ten of these folds.

*The longitudinal striæ*, which in addition to the folds are found in the urethral mucosa, are not in reality straight lines, but they appear so when uniformly stretched by the urethroscope. They are vascular streaks of a fairly bright red colour radiating from the central figure. Tilting the tube enables them to be studied in their natural state. They are seen most clearly on the roof, and, like the longitudinal folds, are most prominent in the well-developed penis of robust subjects.

*The central figure* varies in outline at different points of the canal. Holding the endoscopic tube with gentle traction exactly parallel with the urethra ensures the central position of the figure. In the bulb it appears as a perpendicular fissure, but if the posterior urethra is approached the bulging floor of the urethra gives it a semilunar outline. In the pars pendulosa it is a rounded fossette or a transverse slit, while in the glans it forms a perpendicular, slightly oval, or triangular fissure.

*The colour of the mucous membrane* appears as a pale yellow transfused with a dull red tint. The red is most in evidence posteriorly ; it shades off to rose-pink in the pars pendulosa, and in the glans the red is almost absent. The colour varies in different individuals and at different times in the same individual. Thus Luys noticed that a sudden blanching of the mucosa may occur simultaneously with blanching of the face and indicate the onset of a fainting attack. As the red colour depends on the vascularity

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of the mucous membrane it is influenced by the pressure of a large tube, the amount of traction practised, and the application of local anæsthetics.

*Lustre*.—The healthy mucous membrane has a uniformly smooth and glistening surface.

One or more of the *large lacunæ* are frequently distinguishable on the roof of the anterior part of the urethra. They form triangular pockets, the apex of the triangle being directed towards the central figure.

The small lacunæ as well as the glands of Littre and the orifices of Cowper's glands are not visible in health unless considerably magnified.

*The normal posterior urethra as seen through the urethroscope*.—The most important part of the posterior urethra is the region of the verumontanum. In fact, the floor of the posterior urethra is the seat of the great majority of the lesions which require attention, and therefore in using the Wossidlo urethroscope the end-piece which allows of this surface being examined should, in the first instance, be used.

The prostatic urethra is a deeper red than any other portion of the urethra. Behind the verumontanum, the prostatic fossette is seen extending to the neck of the bladder. The mucosa of the floor is thrown into folds radiating from the neck of the bladder in a fan-shaped manner. As the urethroscope is withdrawn the verumontanum bulges into view. On the front aspect of the apex of the mound the prostatic utricle may be seen as an oval slit, and in the sulci on either side some of the ducts of the prostate may be visible. The openings of the ejaculatory ducts are not usually seen; but they may be found on or near the lips of the prostatic utricle, or they may be placed in the grooves at the side of the verumontanum. Continuing forwards, the verumontanum

In formation the verumontanum shows a considerable amount of variety. It is usually about the size of a split pea, but it may be so small as to be difficult to locate, or so large as to fill the whole prostatic urethra. Occasionally it assumes a cock's-comb appearance. In colour it is usually a shade paler than the neighbouring mucous membrane.

A provisional diagnosis of the position and nature of a chronic gonococcal or post-gonorrhœal lesion is possible by the use of the button-headed probe, the scrutiny of the urinary and other washings of the urethral channel, and the microscopic examination of the secretions ; but when depending alone on these diagnostic measures the risk of error is considerable, and in no case can a diagnosis be made with any definite assurance of accuracy without having recourse to the urethroscope. A mere list of the lesions which can be demonstrated through the urethroscope will prove the justice of this statement.

1. Infiltrations : (a) soft ;  
(b) hard.
2. Glandular disease : (a) with pouting and inflamed orifice ;  
(b) with closed orifice, cystic.
3. New growths : (a) condylomata acuminata ;  
(b) polypi.
4. Erosions and granulations.
5. Fissures.
6. Epithelial excrescences.

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Of these only the gross forms of infiltration can be differentiated with any certainty apart from urethroscopy, and it is obvious that no general scheme of treatment suitable for all of these conditions, and therefore applicable to every case of chronic gonorrhœa, could be proposed. Success in the treatment of many chronic gonorrhœas is thus dependent on a thorough and complete diagnosis, which is possible only with the help of the urethroscope.

*Infiltrations.*—It is to the work and teaching of Oberlaender that we owe our knowledge of this subject. He divides infiltrations into two main groups, the soft and the hard ; but a considerable proportion are mixed or transitional, and all forms may be present in the same urethra.

*Soft infiltrations* are present in acute urethritis. In the event of the continued survival of the gonococcus the infiltrated areas surrounding the infected sites fail to undergo absorption. The mucous membrane at these points remains swollen and hyperæmic, but as there is no appreciable narrowing of the urethral lumen, no obstruction is offered to the introduction of the urethroscope. A single soft infiltration may be found or several may be present at the same time. They are most frequently situated in the pendulous urethra, especially in the neighbourhood of the penoscrotal angle, less often in the bulb, but they may be found in any part of the urethral mucosa.

The increased vascularity of these areas causes them to appear more vividly red than the healthy mucous membrane. They bleed readily. The introduction of a tube or swabbing will usually produce some oozing.

The epithelial covering in the earlier stages appears brightly polished and glistening, but as de-

squamation proceeds the lustre is lost, and minute erosions or bright red granulations may be seen.

The longitudinal folds are reduced to about half their normal number, and they are not so well defined.

The striæ are not visible in the infiltrated area. The central figure is also absent in well-marked cases, and in other cases it is displaced and distorted.

The lacunæ of Morgagni are always abnormal. They appear as pinhead projections with red, swollen, crater-like orifices exuding a muco-purulent discharge.

The glands of Littre are not seen in soft infiltrations.

*Hard infiltrations.*—Oberlaender usefully but arbitrarily subdivides hard infiltrations into three classes.

Those of the first degree are cases in which the lumen of the urethra is not markedly contracted. In those of the second degree the urethra is obstructed but still allows the passage of instruments equal to at least number twenty-three, Charrière. In the third degree only instruments smaller than twenty-three can be inserted. Classes two and three constitute what are generally recognised as “strictures.”

Hard infiltrations are found most commonly about the middle of the pendulous urethra and in the neighbourhood of the bulb. As in the soft variety, they may be single or multiple. Only in rare cases is there a sclerosis of the entire urethra.

The most striking feature of the hard infiltration, as seen through the urethroscope, is its anæmic appearance. Progressively with the deposit of fibrous tissue in an infiltrated area the blood-vessels decrease in size and number until finally the colour is reduced to a pale yellow or dirty white.

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In early cases the epithelium has lost its lustre, while the epithelial surface is irregular, in part exfoliated and in part hypertrophied and keratinized, with projecting points or even small excrescences.

As an infiltration becomes more fibrous, the longitudinal folds continue to decrease in definiteness and in number until they disappear entirely, and the affected area presents the appearance of an inelastic non-collapsible tube.

The central figure, as one would expect in such circumstances, is replaced by a funnel-shaped cavity.

The lacunæ and the glands of Littré are always

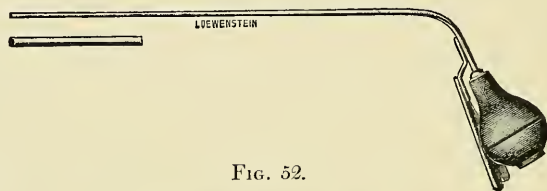


FIG. 52.

Kollmann's suction pipette.

altered in appearance. Oberlaender described two characteristic changes—

1. The glandular or moist form, in which the glands are actively excreting inflammatory products and the gaping ducts appear as minute red rings covered with secretion.

2. The follicular or dry form, in which the glands have shrunk and atrophied or are represented by closed follicles. The expression “dry” is used here with reference to the glands only. There is usually some gleet discharge present in these cases.

Frequently both of these types are seen in the same urethra, especially in cases undergoing dilatation treatment. The conversion of the dry into the moist type is a movement in the direction of recovery, and indicates that the treatment is acting beneficially.

*Papillomatous growths* histologically identical with the gonorrhœal warts (*Condylomata acuminata*) which commonly grow in the preputial sac, are occasionally found in the urethra on making an endoscopic examination. Minute papillary projections may occur in great numbers. They have been seen to cover the whole mucous membrane of the urethra. Flat sessile warts are frequently mistaken for erosions. Large warts are easily identified. They may occasionally be so large as to retard the flow of urine. These mucous membrane warts are soft and friable. In colour they are different shades of red. They can be moved about and their base defined by the urethroscopic probe. They can be snared or curetted, but as a rule they disappear quickly under treatment by injections of dilute lactic acid (1:200) or limited applications of the pure acid through the urethroscope, and this method avoids the formation of cicatrices which may narrow the lumen of the urethra.

*Fissures* parallel with the axis of the urethra occur even apart from traumatism. These sluggish cracks of the mucous membrane heal after careful dilatation and antiseptic irrigation.

*Cysts*.—In addition to the cystic degeneration present in the dry form of hard infiltration, larger cysts are met with on rare occasions. They spring from Littré glands as a rule, but blockage of the duct of a Cowper's gland may also originate a large cyst.

*Diseased conditions of the posterior urethra as seen through the urethroscope*.—Urethroscopic examination of the posterior urethra will in many cases reveal a lesion requiring special treatment before cure can be obtained. Disease of the verumontanum, the prostatic utricle, and prostatic ducts may give rise to no

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characteristic physical signs which would enable a definite diagnosis to be made apart from direct inspection.

The posterior urethra may be the seat of the same pathological lesions as are seen in the anterior urethra, including soft and hard infiltrations, erosions, and papillomata.

*The soft infiltration* is recognised by its deep red colour, tendency to bleeding, and the decreased lustre of the epithelium. This is the common lesion in the posterior urethra.

*The hard infiltrations* are distinctly paler than the surrounding membrane, and in advanced cases are slate-grey or yellow in colour. Owing to the absence of glands they resemble the dry form found in the anterior urethra rather than the moist.

Infected prostatic ducts are encircled with a ring of red and œdematous mucous membrane.

The prostatic utricle is sometimes the seat of a chronic inflammation. Its orifice may be patulous with a congested ridge-like edge.

The verumontanum furnishes evidence of disease in most cases of chronic posterior urethritis. Usually it presents the features of a soft infiltration, being swollen, reddened, and bleeding when touched. It may, however, be sclerosed, when it will appear yellowish red and wrinkled.

Papillary and polypoid growths, 1–2 centimetres in length, are not rare in the posterior urethra.

When one remembers that the posterior urethra is an important junction in the sexual circle, disease of which is liable to set up a train of symptoms, nervous and toxic, which gains momentum the longer it is allowed to run, the wisdom of an early and careful examination will be obvious.

# PLATE VIII.

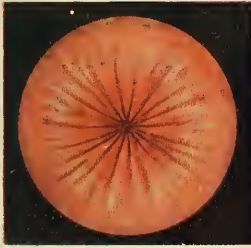


FIG. 1.



FIG. 2.



FIG. 3.



FIG. 4.



FIG. 5.



FIG. 6.



FIG. 7.



FIG. 8.



FIG. 9.



FIG. 10.

FIG. 1.—Normal Urethral Mucosa. FIG. 2.—Chronic Urethritis with Erosions. FIG. 3.—Chronic Urethritis, Vesicular. FIG. 4.—Stricture of the Urethra. FIG. 5.—Follicular Abscess. FIG. 6.—Cysts of the Mucosa. FIG. 7.—Posterior Urethra. The Verumontanum. FIG. 8.—Papilloma of Prostatic Urethra. FIG. 9.—Bi-lateral Prostatic Hypertrophy; Posterior Urethral View. FIG. 10.—Bi-lateral and Median Prostatic Hypertrophy; Posterior Urethral View.

## ANTERIOR AND POSTERIOR URETHROSCOPIC PICTURES.

"By permission, from 'The Practice of Urology', Chetwood."



## CHAPTER IX

### NON-GONORRHOÆAL URETHRITIS (URETHRITIS SIMPLEX)

It is not proposed to present here an exhaustive study of the various forms of urethritis due to other than a gonococcal origin. All that is intended is a short statement of such inflammatory conditions of the urethra as might give rise to the suspicion of gonococcal infection.

Urethritis arising from *mechanical, chemical, or thermal irritation* is generally ascribed to its proper source, except in the case of children. Exploration of the urethra will determine the presence or absence of foreign bodies mischievously inserted from without, or calculi impacted during their passage from the bladder or kidneys.

Indirect trauma, especially prolonged bicycle or horse riding, has been known to excite symptoms of urethritis. In these cases pain in the perineum and prostatic tenderness have been associated with a mild muco-purulent urethral discharge.

These symptoms are particularly liable to occur in youths, and in hot weather when profuse perspiration and consequent concentration of the urine tends to excite an irritation of the mucous membrane.

Chemical urethritis is usually due to prophylactic injections of domestic antiseptics, and appearances simulating a true gonorrhœa may thus be induced, but microscopic examination of the secretion will

show that the gonococcus is absent. Severe pain, hæmorrhage, and discharge of pus and fragments of necrosed tissue may result from the use of unsuitable solutions of such urethral irritants as perchloride of mercury or carbolic acid. The anterior urethra is alone implicated in these cases, and cicatrization may finally end in stricture formation. In traumatic urethritis there is no incubation period. The inflammatory reaction appears quickly and, if the exciting cause is removed, soon subsides, unless considerable damage has been done to the tissues. Mild cases require little in the way of treatment. Balsamics assist in decreasing the urinary discomfort, and in severe cases cocaine and adrenalin injections may be indicated. Overdoses of certain drugs and articles of diet have been responsible for urethral discharge, e.g., cantharides, asparagus, rhubarb, etc.

*Organisms producing urethritis simplex.*—Of the pathogenic organisms which, as an incident in a general infection, may be found in the urethra, mention may be made of the typhoid bacillus, the tubercle bacillus, the treponema pallidum, and the meningococcus; but these infections are not likely to give rise to any confusion with gonorrhœa.

The infective agents which have been known occasionally to simulate a gonococcal inflammation are—

1. The micrococcus catarrhalis.
2. The bacillus coli.
3. Staphylococci.
4. Streptococci.
5. The influenza bacillus.
6. The pneumococcus.
7. Friedländer's bacillus.
8. Diphtheroid bacilli.

A few cases of pneumococcus urethritis have been reported.

In some cases in which the gonococcus could not be proved, staphylococci or streptococci have been present in such numbers as to suggest that they were the etiological factor in the production of the disease.

The influenza bacillus and Friedländer's bacillus have been found together in a few cases.

In urethritis, where there was no likelihood of a gonococcal basis, my experience is limited to the bacillus coli, the micrococcus catarrhalis, and a small staphylococcus albus. The bacillus coli I found the causative organism in a subacute urethritis in a young boy; the micrococcus catarrhalis produced a moderate urethritis in a young married man; the staphylococcus caused little evidence of inflammation in the male, but excited an acute vaginal discharge in two female partners, the man merely acting as carrier probably from a third female.

None of the above infections excite such an acute inflammation as does the gonococcus. The urethritis is subacute in type, and tends in most cases to early spontaneous cure.

The diagnosis depends on the history, on the mild course, and essentially on the microscopic and cultural examination of the secretion.

It is possible that an even larger number of bacteria is involved in female genital infections, and that the male acts as carrier of these infections without being aware in his own person of any condition of disease; but of course the mode of infection is not necessarily venereal either in the male or female.

There is considerable variation in individual susceptibility. Fair people of either sex are more liable to infection, and are more difficult to cure.

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While it remains true that these cases are comparatively rare, the possibility of a non-gonococcal genital infection accentuates the advisability of the microscopic control of each case.

Much work still remains awaiting investigation on this subject.

## CHAPTER X

### GONOCOCCAL BALANITIS AND BALANO- POSTHITIS<sup>1</sup>

THE preputial sac being lined by squamous epithelium does not present a surface suitable for the activity of the gonococcus, and on that account it cannot be said that a gonococcal invasion of the tissues of the inner layer of the prepuce, coronal sulcus, or glans is of frequent occurrence. In fact, the possibility of such an event is denied by most authorities. That this assumption is erroneous will be proved later, but probably the inflammatory swelling and œdema of the prepuce and glans so commonly encountered in association with gonorrhœa is in most cases produced by contact with the irritating urethral discharge, and the gonococcus in the preputial sac then plays for the most part the rôle of a passenger. As a consequence of the œdematous swelling of the prepuce a condition of marked phimosis, in which the prepuce cannot be retracted, or of paraphimosis, in which the retracted foreskin forms a constricting band behind the glans, may follow, and unless successfully treated ulceration or even sloughing may result.

*Anatomy.*—The modified skin which forms the inner covering of the prepuce is continued over the

<sup>1</sup> Balanitis is an inflammation of the glans, and Posthitis is an inflammation of the inner lamella of the prepuce. Both surfaces are usually affected.

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glans, and enters the urethra as far as the fossa navicularis. It is destitute of mucous glands, but sebaceous glands are present. These are prominently seen in the neighbourhood of the coronal sulcus (glands of Tyson) (Fig. 53). In addition to these sebaceous glands there are minute epithelial pits scattered over the surface, but they have no

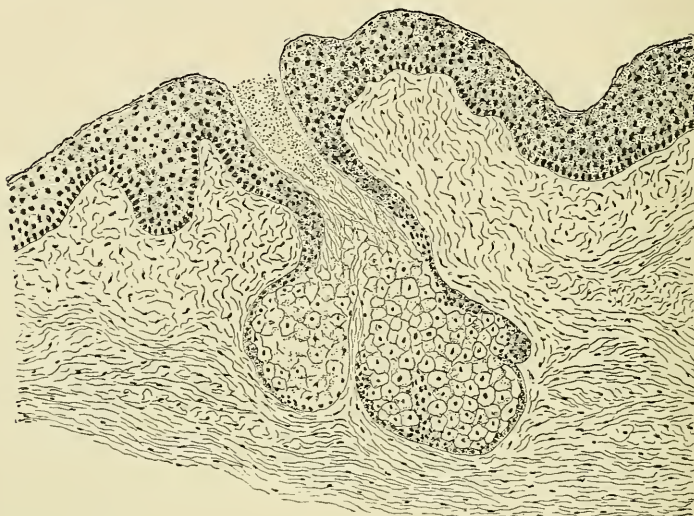


FIG. 53

Showing a section (much magnified) through one of Tyson's glands in the prepuce of a young child. (Taylor.)

glandular epithelium. Two specially large crypts, sometimes also spoken of as glands of Tyson, are frequently to be found one on either side of the frœnum.

The secretion which collects in the sulcus is composed of epithelial debris, sebaceous material, and micro-organisms.

*Bacteriology.*—In the normal preputial cavity various micro-organisms are found, the most constant of which are included in the following list (Scherber):—

1. *The smegma bacillus* is a long, thin bacillus, faintly Gram-positive. It is seldom quite straight, but is more often irregularly curved or twisted, and in many instances is seen to be undergoing segmentation.

2. *A diphtheroid bacillus*, short, Gram-positive. Club shapes, spindle shapes, and swollen or thickened forms are seen.

3. *A Gram-negative bacillus*, with rounded ends like the influenza bacillus, occurs in large numbers.

4. *A Gram-positive coccus*, which lies singly or in groups of two or more, or in short chains.

5. *Bacillus coli group*, Gram-negative, straight bacillus, with rounded ends.

6. *Vibrios*, with tapering ends: both Gram-positive and Gram-negative forms are seen.

7. *Spirochætæ*. Gram-negative and slender.

8. *The ordinary pyogenic staphylococci and streptococci* are also found.

It will be seen that we have here a flora with a sufficiently mischievous potentiality requiring only the production of a lesion to give its pathogenic members their opportunity. Regular cleansing has a marked effect in reducing the numbers of these organisms, and, on the other hand, phimosis favours their growth.

Balano-preputial inflammation may arise from causes other than venereal infection, and it may also be produced by venereal infection in which the gonococcus plays no part; but at the moment we are only concerned with the condition as a complication of gonococcal urethritis. The presence of a urethritis, in cases where the urethra cannot be inspected, can be proved by the appearance of the urine passed after a thorough syringing of the preputial cavity.

Gonorrhœal balanitis may be acute or chronic, and the symptoms and treatment of acute disease depend upon the relationship of the prepuce to the glans.

*Symptoms of acute balanitis with phimosis.*—In this condition the long prepuce, with its narrowed orifice, forms a sac in which the urethral discharge tends to stagnate, and the irritation set up by the gonotoxine produces an acute diffuse inflammation of the whole balano-preputial surface, which becomes swollen and œdematous, reducing still further the lumen of the orifice and preventing drainage.

When the inflammation is intense one or more areas of necrosis may eventuate with a perforation, usually on the dorsal surface, through which the glans may present.

The treatment may be expectant or operative.

*Expectant treatment* consists of rest in bed with elevation of the penis, and frequent cleansing of the preputial cavity by means of a large syringe or an irrigator. The antiseptics which are most useful are permanganate of potash, nitrate of silver, perchloride of mercury, aluminium acetate, and lactic acid. Previous to the irrigation the pus may be removed by instilling some hydrogen peroxide. This is especially beneficial when the condition is complicated by the presence of soft sores. Operative treatment is indicated in hyperacute conditions and cases unresponsive to a few days' expectant treatment. The measures which may be adopted are, either a median dorsal slitting of the prepuce, or two lateral incisions, with complete circumcision later; or, in suitable cases, circumcision may be undertaken at once.

*Paraphimosis* complicating gonorrhœa is due to inflammatory swelling of a short or retracted foreskin. The glans is congested and swollen, and œdematous

tumefaction occurs in the region of the frænum and also on the dorsal portion of the everted prepuce. The constricting band is not the preputial limbus. It consists of an aggregation of the circular fibres found in the connective tissue on the dorsum of the prepuce. Reposition of the glans may be attempted by efforts to express the œdema and congestion from the glans and the bulging parts of the foreskin. Compression by elastic bandaging will, in a few minutes, considerably reduce the swelling, when the skin of the penis may be pulled forward at the same time as the glans is digitally compressed and pushed backwards. In the event of failure of this method, the œdematous ring may be subjected to multiple puncturing with a small sharp-pointed bistoury, a moist dressing applied, the penis elevated, and the patient kept in bed.

In spite of the obvious interference with the circulation, sloughing, in the absence of phagedenic ulceration, seldom or never occurs.

Operative treatment is therefore only adopted with a view to hasten recovery.

To cut the constricting fibres a fine, sharp-pointed bistoury is inserted through the skin on the dorsum of the penis proximal to the constriction. The knife is passed forwards in the subcutaneous tissue close to but carefully avoiding the tunica albuginea until the tightened fibres are felt and severed, when the œdema and congestion will soon subside and the prepuce can be replaced.

#### CHRONIC GONOCOCCAL BALANITIS

Reference has already been made to the prevalent opinion that gonococcal invasion of the tissues of the preputial sac does not occur. If this were so, then

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chronic gonococcal balanitis would be non-existent. In order to refute this teaching, one of the cases which have come within the writer's experience may be quoted :—

A bachelor of virtuous habit on the occasion of an unfortunate lapse over eight years ago contracted gonorrhœa, which ran a usual course and was apparently cured within six weeks. Since then he had been unconscious of any disease until a few months ago, when he developed influenza, which confined him to bed for three days. It had been his daily practice to retract the elongated prepuce and wash the glans, but this was omitted during those three days. Three days later a urethritis was in evidence, for which he sought my advice. The patient strenuously denied the possibility of any source of infection other than the neglect of his usual toilet.

On retracting the prepuce and removing the creamy discharge, the glans was seen to be red, moist, and finely granular over one-third of its surface, and many of the glands of Tyson in the coronal sulcus were actively inflamed. A tingling heat and smarting were complained of in the affected parts. After careful cleansing, scrapings taken from the surface of the glans showed numbers of gonococci and no other organisms.

This case well illustrates several points in connection with gonococcal infection. In the first place, the long period during which infectivity may continue is proved with little possibility of error. My knowledge of the patient enables me unhesitatingly to accept his word with regard to any subsequent exposure to venereal disease. Then it proves that a relative immunity to the particular

strain of gonococcus is acquired by the urethra, as the urethritis was particularly mild and of short duration. It also shows that a tissue infection of the glans is possible in spite of the covering of squamous epithelium. Probably the inveteracy of the infection is due to implication of the sebaceous glands.

The treatment in addition to circumcision consists of antiseptic baths and dusting powders such as bismuth, zinc, calomel, and boric acid, with applications several times each day of moderately strong silver solutions until the gonococcus has been eliminated.

## CHAPTER XI

### GONOCOCCAL PROSTATITIS

IN most, if not all cases of posterior urethritis, the ducts of the prostate gland are more or less included in the area of inflammatory reaction ; but unless the gonococcus spreads along the ducts into the substance of the gland, a true prostatitis cannot be said to be present. This, however, does occur in a considerable number of cases which different authorities variously estimate. The published figures differ so widely that little object is to be served by quoting them. The disagreement is due to the different methods adopted in examining, and the amount of inflammatory involvement of the gland considered necessary before it could be classified as a prostatitis.

The main importance of the question centres in the fact that in a large percentage of the chronic cases of gonococcus infection (60 per cent to 90 per cent), examination will reveal a prostatitis as a source of continued infection. As the prostate is a gland which plays a prominent rôle in general metabolism as well as in sexual life, and as gonorrhœa is the disease to which it is most liable at least in early adult life, no excuse is needed for giving considerable space to its consideration.

*Anatomy of the prostate.*—The prostate, in size and shape, is comparable to a chestnut ; to be geometrically exact, it is an oblate conoid. The base is

directed upward in contact with the bladder, and the apex rests on the triangular ligament. The greatest diameter is the transverse near its base, where it measures  $1\frac{1}{2}$  inches (36 millimetres). The vertical averages  $1\frac{1}{4}$  inches (30 millimetres), and the antero-posterior  $\frac{3}{4}$  inch (18 millimetres). The normal gland weighs from 16 to 24 grammes.

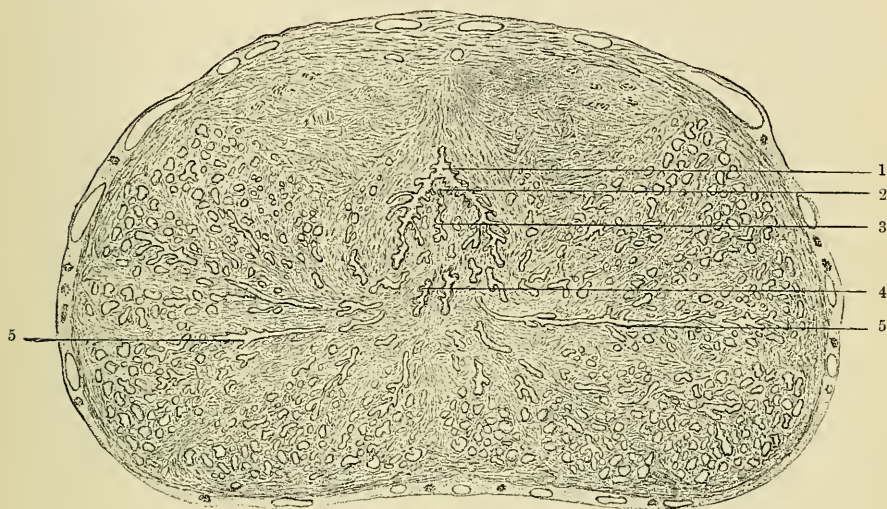


FIG. 54.

Showing section (much magnified) of normal prostate of a subject aged nineteen years, made through middle of verumontanum: 1, urethra; 2, verumontanum; 3, sinus pocularis; 4, ejaculatory ducts; 5, prostatic glands. (Taylor.)

The posterior surface is pierced obliquely in the middle line above by the two ejaculatory ducts lying side by side. Where these enter the gland there is a notch which extends downwards as a median groove separating the gland into two lateral lobes. The lateral lobes meet in front of the urethra, which is enclosed in the substance of the gland. The portion of the organ above the ejaculatory ducts, and lying between them and the urethra in front and the bladder

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above, is spoken of as the middle lobe. The posterior surface is separated from the rectum only by cellular tissue.

*Structure.*—The prostate possesses a dense fibromuscular capsule, arising from which a median and other septa divide the gland into about thirty lobules. Bundles of unstriped muscle follow the connective

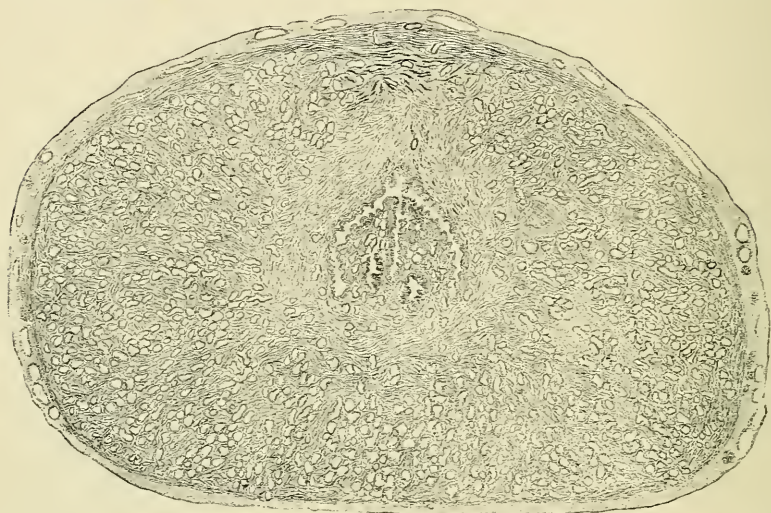


FIG. 55.

Showing prostate of a man in which senile changes are beginning to develop. This section was made through the posterior portion of the prostate. Here the ducts run forward, and they therefore appear in cross-section in the drawing. The lobulation apparent in the prostate of the young subject (see Fig. 54) is no longer distinct, owing to the development of fibrous and muscular tissue. Voluntary muscle-fibres are prominently developed on the superior surface of the organ. In the verumontanum the left ejaculatory duct is seen opening centrally into the prostatic sinus. The right ejaculatory duct shows as yet no communication with the prostatic sinus, but opens at a point further forward; (much magnified). (Taylor.)

tissue framework; in fact, they constitute the main bulk of the stroma.

The spongy glandular substance consists of fifteen to thirty tubular alveoli, each opening through its own duct direct into the urethra. The epithelium is

cylindrical, and there are two layers but no basement membrane, the epithelial cells resting directly on the musculo-fibrous tissue. Islands of lymphoid tissue are sometimes found. The prostate contains a complicated system of delicate nerve fibres, ganglion cells, and special nerve endings.

*Physiology of the prostate.*—The prostate is an essential component of the sexual system; but not only is its external secretion a vital element of the seminal fluid, the prostate also furnishes an internal secretion which, in addition to governing the activity of the testicles, influences the general metabolism of the body. The gland only reaches its full growth after puberty. Castration of the child prevents the development of the prostate. Castration in the adult is followed by atrophy, but the actual power of coition is not lost for some years, which would seem to indicate that the internal secretion of the prostate is the dominating factor in sexual life.

The experiments of Serallach and Parez, conducted at Barcelona on dogs, have afforded interesting results. They found that removal of the prostate was followed by atrophy of the testicles and disappearance of spermatozoa from the semen. If, however, the animal was given a glycerine extract of the prostate by the mouth, or a portion of the gland was grafted subcutaneously, the degenerative changes were averted. The effect of the internal secretion on the general metabolism is illustrated by another experiment of the same observers. Twin pups, as nearly as possible alike, were chosen when sixty days old. To one was given daily doses of the prostate extract, while the other was retained as a control. Five weeks later a testicle was removed from each, and on examination the organ of the puppy which had

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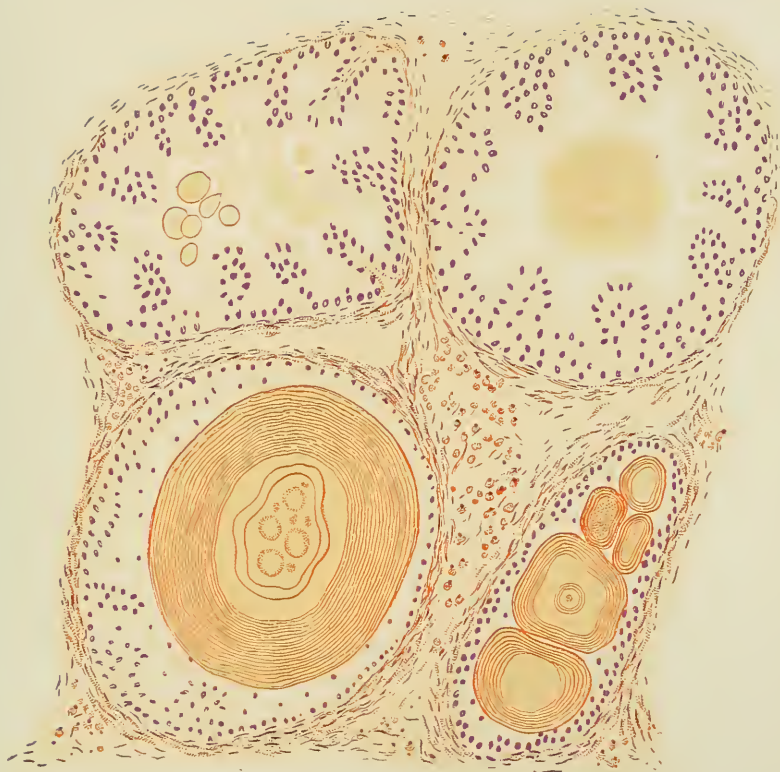
been fed on prostate was found to be in a much more advanced stage of development than that of the control animal. It was also noted that the puppy which was prostate fed was much thinner, more active, inquisitive, intelligent, and excitable than the other.

Congenital abnormalities of the prostate have been noted as part of a general or partial maldevelopment of the sexual system. Fuller reports the case of an adult in whom the prostate was entirely absent. He was capable of indulging in coitus, but spermatozoa were absent from the seminal fluid.

*Characters of the external secretion of the prostate.*—The prostatic secretion is a thin, cloudy albuminous fluid with a characteristic odour. It contains no mucus. In reaction it is in most cases either alkaline or neutral. In a small percentage of cases it is faintly acid. Under the microscope the most striking feature is the presence of lecithin granules in various forms. These readily absorb anilin stains. Other granules are amyloid, “corpora amylacea” (Plate IX), staining blue with iodine and sulphuric acid. Epithelial cells are also noticed, and a varying but small number of leucocytes may be present.

The basic element of the Böttcher or spermatic crystals (Fig. 56) found in the semen is contributed by the prostatic secretion. The crystals are formed by the combination of this base with phosphoric acid obtained from other constituents of the spermatic fluid. The expressed secretion of the prostate will not therefore show any spermatic crystals unless some ammonium phosphate solution be added. For the purpose of demonstrating these crystals, a drop of prostatic secretion is mixed with a drop of 1 per cent solution of ammonium phosphate and

PLATE IX.



Amyloid Bodies in the Prostatic Tubules  
Shown on Transverse Section. [Taylor.]



slowly dried under a cover glass. After a time large numbers of the needle or whetstone crystals will be seen. This is a reliable test for prostatic secretion.

That each duct and tubule of the gland, lined as they are with a susceptible epithelium, is not attacked by the gonococcus in every case of posterior urethritis probably depends on some restraining influence inherent in the prostatic secretion. Bierhoff ascribes this property to the alkaline reaction of the secretion,



FIG. 56.

Böttcher's sperma-crystals. (Taylor.)

in which case the glands whose secretion showed pronounced alkalinity would be those which escaped infection; but Bierhoff states that the secretion even of infected glands is alkaline, and that on this account he failed in his attempts to grow the gonococcus from prostatic discharge. Waelsch suggests that the known antiseptic power of lecithin may be exercised by the granules. As a result of inflammation the power of lecithin production is lost by the secreting cells, and it is true that a small inflammatory zone precedes the growth of the gonococcus along the ducts.

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*Method of examining the prostate.*—Much information regarding the state of the prostate is afforded by actual palpation. The most suitable position in which to place the patient is to have him kneeling on a chair with his arms resting on its back. In this position, if the bladder is distended, good access can be had to the prostate and the seminal vesicles. With the gloved finger well lubricated, a systematic examination of the gland should be made. In the middle line the course of the prostatic urethra should be followed and tenderness or inequalities in its surface noted. Each lobe in turn should then be explored. The two halves should be compared in size and sensitiveness. Any area of tenderness or swelling, or any alteration in consistence either hardening or softening, should be located. The condition of the rectum and of the perineum should also be investigated.

Before the examination is undertaken, the patient should pass a small quantity of urine into a glass to wash out the urethra, or preferably the anterior urethra should be irrigated, and thereafter the patient should pass one or two ounces of urine. After a careful scrutiny of the condition of the prostate by the finger in the rectum, the gland should be gently but thoroughly massaged, each lateral lobe being stroked towards the middle line to express the secretion into the urethra. Some of this secretion may escape along the urethra, when it should be collected for microscopical examination. It may be allowed to drop directly on to one end of a slide, on which it should be spread as in making a blood smear.

Upon completion of this operation, the patient again passes a small quantity of urine, which will carry with it the expressed products of the prostate.

The bladder is then emptied into a fresh glass vessel, and the whole tract, bladder included, is thoroughly washed out with a weak permanganate or silver nitrate solution. The urine containing the prostatic secretion should be filtered or centrifugalised and the deposit examined microscopically.

#### CLASSIFICATION OF GONOCOCCAL PROSTATITIS

Gonococcal prostatitis may be acute or chronic. As regards the acute forms nearly all writers, especially in Germany and America, adopt the classification originally proposed by Segond. They speak of (a) catarrhal, (b) follicular, and (c) parenchymatous prostatitis.

In the *catarrhal type* the inflammatory reaction is described as being confined to the epithelium of the ducts and tubules. Gonococci spread along the epithelial surface, but do not penetrate into the tissues.

The *follicular type* results from a case of catarrhal prostatitis, in which instead of subsiding the process increases in intensity, and one or more of the ducts become occluded with the formation of small pseudo-abscesses. The stoppage in the duct may be overcome by the increasing pressure behind it, and, the cyst discharging its contents into the urethra or otherwise, resolution and absorption may take place.

The *parenchymatous variety* is a further stage of the acute inflammatory process. The inflammation extends from the epithelium deeply into the tissues of the organ. Abscess formation is common in this type.

I have considerable difficulty in accepting this classification. It seems to me to fail in the purpose

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for which all classification is intended. It does not simplify the teaching of the subject ; it obscures the clinical picture, and gives a false perspective to some details. The expression "catarrhal prostatitis" is inaccurate and misleading. The prostatic tubules have no mucous membrane properly so called, and secrete no mucus, and it is impossible to imagine the gonococci not penetrating into and beneath the epithelium. The term follicular prostatitis suggests invasion of the gland follicles in contradistinction to localisation of the infection in the ducts. Why it should be adopted as a designation for cystic abscess is incomprehensible. The occlusion of a duct is not characteristic of a distinct type of prostatitis, but is a complication occurring in the course of an ordinary infection, and should be described as such. The parenchymatous type includes hyperacute cases, in which there is considerable risk of abscess formation.

An attempt to classify disease conditions of an organ such as the prostate may be governed either by differing pathological characteristics, distinctive clinical symptoms, or by anatomical considerations. As a rule, when the pathological conditions vary, a different train of clinical symptoms is induced, so that from both of these standpoints classification is reinforced. In prostatitis we find no essential difference in the pathological processes at work other than one of acuteness, and this is mirrored by the clinical symptoms.

It is universally recognised that there may be an acute, subacute, or chronic inflammation, and that the chronic condition may follow from the acute or subacute. The not uncommon assertion that a case may be of the chronic type from its inception is surely in the case of gonococcus infection a misuse of terms. What is

doubtless meant is that a mild subacute case may ultimately become chronic. There is no special feature of chronic as opposed to mild subacute gonococcal inflammation other than the time limit produces.

In describing urethritis everyone adopts the grouping into three principal types—subacute, acute, and hyperacute. Pseudo-abscesses and abscesses occur, but they are incidents and not characteristics; and although relatively more common and important in connection with prostatitis, they are not sufficiently so to form a basis for classification at the expense of the more obvious and reasonable subdivision according to the acuteness of the inflammation.

The “subacute” group would include all cases where the infection was comparatively superficial (epithelium and immediately underlying tissue) and giving rise to mild symptoms. The “acute” designation would be descriptive of a more severe inflammatory reaction in which the objective and subjective symptoms indicated an inflammatory hyperæmia and infiltration of a lobule, lobe, or of the whole gland, signifying penetration of the gonococcus into the stroma. The previous sentence suggests an anatomical subdivision, lobular, lobar, and glandular; but clinical experience does not meantime warrant its general adoption, although in individual cases the terms lobular and lobar could occasionally be used with descriptive accuracy. As a rule the whole gland is more or less involved, although at any given time different lobules may have arrived at different stages of the inflammatory process, as evidenced by variations in the consistence of the gland at separate points of its surface. The term hyperacute would describe all those cases in which rapid œdematous swelling

of the gland gave rise to distressing symptoms. The lobular pseudo-abscess should be noted as being liable to occur in the subacute and acute types, and abscess formation in the hyperacute. Confining oneself to this classification enables the disease process to be described with faithful adherence to the known tendencies of gonococcal activity as well as to the usual clinical progress of the disease.

*Acute gonococcal prostatitis.*—Spreading along the ducts, the gonococcus, in a moderately acute case, produces the ordinary inflammatory reaction. The epithelial cells are loosened and shed. The secreting cells are altered in formation and function. They swell and become incapable of secreting the finely-divided emulsion of lecithin granules. Polynuclear leucocytes are extruded in numbers, and round-celled infiltration occurs in the subepithelial tissue. A sero-purulent secretion occupies the lumen of the tubules, whence it is poured into the posterior urethra. In a short time the discharge has the appearance of yellow pus. The posterior urethra, as seen through the urethroscope, has been described by Socin and Burckhards. The mucous membrane was swollen, deep blue-red in colour, and bled easily. The crista urethræ was so inflamed that it filled the whole lumen of the canal. Pus oozed from the mouths of the prostatic ducts.

On palpation through the rectum evidence of the inflammation of the gland may be perceived; on the other hand, there may be little indication of anything abnormal other than would be obtained in a posterior urethritis without prostatitis. The difference of sensitiveness found in the posterior urethra of different individuals has already been referred to, and the same peculiarity is found in regard to the pros-

tate, some being much more sensitive than others. In all cases if the inflammatory process has extended so far along the tubules as to approach the posterior surface of the gland, hypersensitive areas will be found, and deep pressure will in most cases elicit tenderness; but there may be considerable involvement of that portion of the gland surrounding the urethra without any diagnostic evidence being procurable by means of palpation. The occurrence of a lobular cyst (pseudo-abscess) through occlusion of a duct may be felt as a small, very sensitive protuberance the size of a split pea on the otherwise smooth surface of the lobe. If only a thin layer of tissue separates the cyst from the rectum, softening may be made out. Should this pseudo-abscess discharge, as usually happens, into the urethra, the nodule will be replaced by a depression. If the contents do not escape in this way, absorption may ultimately take place. When the infection extends more quickly and more deeply into one lobe than into another, variations in consistence may be felt. In the most severe cases, a lobe or the whole gland will be enlarged, hot and tender. Engorged blood-vessels will be felt coursing on the tense elastic surface of the organ, and a feeling of pulsation may be conveyed to the examining finger.

The inflammation usually begins to subside in from five to ten days, and complete resolution may even-tuate; but in many cases a chronic infection remains. On the other hand, the process may increase in intensity, and abscess formation may then be anticipated.

*Subjective symptoms.*—In subacute and moderately acute cases the condition cannot be differentiated by the subjective symptoms from the accompanying

acute posterior urethritis. There is an actual increase in the amount of discharge, but this is only evident on close and continued examination of the urine. Difficulties in urination and defecation are increased; but as these symptoms are all comparative, they have little diagnostic value. In severe cases, however, there is complaint of a foreign body in the rectum causing continuous urinary and rectal tenesmus. Pain is always very considerable, and radiates from the perineum to the glans, down the thighs, and across and up the back.

*The diagnosis* is dependent on the examination of the prostatic secretion and on rectal palpation, but some assistance is obtained from the three-glass urine test. The first glass as usual contains the pus carried from the whole urethra. The second shows the condition of the urine in the bladder with its regurgitated pus from the posterior urethra. The third shows the same as the second plus such discharge as may be squeezed from the prostate in the final stages of micturition. If the prostate be massaged in an interval between the passage of glass two and glass three, there is much more certainty of the third glass containing prostatic contents. The first and the third glasses should show greater concentration of pus than the second. During the manipulation of the prostate some of its discharge may escape from the meatus, and this should be caught on a glass slide for examination. The contents of the third glass should be filtered or centrifugalised and the deposit microscopically examined.

More exact results can be obtained by washing out the urethra and bladder with boric solution, ultimately leaving an ounce or so of the solution in the bladder. The prostate is then massaged, and finally

the retained solution is expelled, carrying in front of it the prostatic discharge. This is removed by the centrifuge and examined. This procedure as a means of diagnosis will, however, be contra-indicated in most cases, and even massage of the prostate should only be undertaken with caution, as it is liable to cause an extension of the disease in acute conditions. It is possible that if done jerkily or roughly traumatism might be caused to the hyperæmic and tender tissue, and there is the further risk of cocci being sucked into unaffected ducts or more deeply into the tubules. If massage is practised, care must be taken that the pressure is sufficiently gentle and equable.

*The secretion of the infected prostate* shows characteristic macroscopic as well as microscopic changes. The normal secretion is an opalescent, slightly milky emulsion, neither watery nor yet of tenacious consistence. The secretion from the diseased gland is a mixture of serous exudation and pus. It is always alkaline to litmus. It has a dirty grey colour, and has not the character of a finely divided emulsion, but of a suspension of irregular particles.

Minute particles, flakes, or comma-shaped threads are expressed from the ducts with the discharge and found in the prostatic urine glass. They are composed of pus and epithelial cells cemented together by serous exudate.

Under the microscope are seen numerous polynuclear leucocytes, some of them containing lecithin granules, for which they seem to have an affinity, and also epithelial cells sometimes showing the two-layer arrangement. Lecithin granules are not entirely absent, but are much scantier than in the normal secretion. Only rarely are amyloid bodies noticed. The pus cells in the early stages are mostly

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polynuclear. Some writers maintain that a high proportion of eosinophile cells is of diagnostic importance. Both intracellular and extracellular gonococci are found, but they are not so numerous as in the urethral secretion.

### THE TREATMENT OF ACUTE PROSTATITIS

In the acute stages it is necessary to keep the patient in bed. In many cases no persuasion is needed, as he is unable to move about. Careful dieting and regulation of the bowels are important. Hot sitz baths two or three times daily, lasting six to eight minutes, followed by hot fomentations to the per-

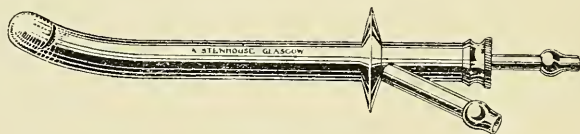


FIG. 57.

Rectal tube for prostatic hydrotherapy.

ineum, will be found soothing. Even more effective is irrigation through a double-channel rectal tube (Fig. 57), by means of which a stream of hot water is made to flow over the posterior aspect of the prostate several times during the day. Care must be taken by external cleansing to obviate the risk of rectal infection. Following this douche a suppository, containing  $\frac{1}{2}$  to 1 grain of opium and  $\frac{1}{4}$  to  $\frac{1}{2}$  grain of belladonna, may be inserted if there is great discomfort. A solution of antipyrine injected into the rectum is also helpful in relieving pain and reducing temperature. In the earlier stage the use of cold instead of hot water may have a restraining influence on the spread of the inflammation, but the effect must be carefully watched. Leeches (ten to twelve) applied to the perineum are often of distinct value.

If there be retention of urine which is unrelieved by hot sitz baths and fomentations, a catheter, preferably a soft one, may have to be passed. Whether a self-retaining catheter should be left in the bladder must be decided on the merits of the particular case. Should one be left *in situ* and increased irritation result, it must be withdrawn. If the passage of the catheter ruptures an abscess there will, of course, be no need to consider the question of a retained catheter. It will seldom happen that catheterization by some form of instrument is found to be impossible, but should such be the case the alternatives are puncture of the bladder through the abdominal wall, or perineal section with bladder drainage. It is sometimes found that after relief has been obtained by bladder puncture a catheter can pass the obstruction or even that this is unnecessary as spontaneous urination may be re-established.

During the height of the inflammation all urethral treatment must be withheld. In picked cases it may be possible to continue Janet irrigations with weak permanganate or silver nitrate solution, but when the symptoms are at all acute it is safer to defer any local treatment of the urethra.

Balsamics have their limited field of usefulness, and urinary antiseptics may be continued with some advantage.

#### PROSTATIC ABSCESS

Abscess formation is an important but fortunately a comparatively uncommon associate of acute and hyperacute prostatitis. At any moment as long as the gonococcus infection is present an acute condition may be precipitated by traumatism or any of the exciting causes of gonorrhœal activity.

Abscess may be preceded by a lobular cyst (pseudo-abscess). When emptying into the urethra is delayed, destruction of the cyst walls converts the condition into one of true abscess. In a hyperacute prostatitis a small focus of pus forming in the stroma may by itself or by coalescing with other similar pockets go on to the production of an abscess.

*Symptoms.*—The patient's temperature chart is not, as a rule, noticeably affected by the occurrence of a prostatitis unless an abscess develops. But in that case, following perhaps on a rigor, the temperature jumps to 103° or 104° F., after which it oscillates between 100° and 102° F. Other indications of septic absorption are headache, dry tongue, thirst, and profuse perspiration.

Fever is not an invariable accompaniment of abscesses. Henrichson reports elevation of temperature in only ten out of thirty-four cases. When the abscess bursts spontaneously into the urethra, as it commonly does, the temperature falls—to rise again—if, on account of insufficient drainage, the pus reaccumulates.

The most urgent complaint on the patient's part is of throbbing pain from a foreign body in the rectum. The pain radiates in all directions, especially on movement. He therefore adopts the position most likely to relieve perineal tension, and lies on his back with the knees drawn up and resolutely objects to being moved.

Owing to the swollen prostate impinging on the urethra, the urine is discharged in a small stream, or there may be complete retention necessitating the use of the catheter. Not infrequently the passage of the instrument ruptures the abscess and pus wells out. The presence of the tender mass in the pelvis

interferes also with bowel movement, which the patient dreads on account of the pain. There may be little or no urethral discharge. This may be due to the urethritis having completed its acute stage, or it may be comparable to the temporary suppression sometimes met with in epididymitis, in which case a recurrence of the discharge may be expected in from five to seven days.

On palpation there is felt projecting into the rectum one or both lobes of the prostate, tense, hot, tender, and, if in the early stage, hard. Softening will be in evidence later, and ultimately fluctuation will complete the diagnosis.

In the great majority of cases the abscess discharges into the urethra in from five to twelve days. There is a sudden violent pain followed by the appearance at the meatus of a quantity of blood-tinged pus. Rupture may be precipitated by palpation of the prostate or by the passage of a catheter.

In addition to the urethral path there are many directions in which a prostatic abscess may seek an exit if not relieved by incision. Second collected 104 cases which discharged as follows :—

1.	Into the urethra . . . . .	64 cases
2.	„ „ rectum . . . . .	43 „
3.	„ „ perineum . . . . .	15 „
4.	„ „ ischio-rectal fossa . . . . .	8 „
5.	„ „ inguinal region . . . . .	3 „
6.	„ „ Through the obturator for- amen . . . . .	2 „
7.	Through the umbilicus . . . . .	} 1 case each
8.	„ „ „ sciatic notch . . . . .	
9.	Into the peritoneum . . . . .	
10.	„ „ „ perivesical cellular tissue. . . . .	
11.	At the angle of the false ribs . . . . .	

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Rupture in two directions may occur simultaneously, and a urinary fistula may be produced.

Under the guidance of modern surgery such results would seldom be allowed to happen, and in any case the relative proportions in the above table are misleading, as many instances of rupture into the urethra are unrecognised. Guiteras, although unable to give definite statistics, states as his opinion that in 95 per cent of cases the abscess finds its way into the urethra.

General pyæmia is rare as a result of prostatic abscess, but it may arise from the loosening of clots from a thrombosed vein on the surface of the gland. The gonococcus is frequently present in pure culture in the early stage, but later admixture with other organisms is the rule; of these staphylococci, streptococci, the colon bacillus, and anaerobic organisms are the commonest invaders.

The possibility of pre-existing tubercular disease of the prostate must not be overlooked. Septic pneumonia is a grave complication which is sometimes encountered.

Extravasation of urine as a result of prostatic abscess has been reported, but it must be uncommon, as the cavity quickly contracts and granulation tissue soon obliterates the sac.

The cicatricial scar may give rise to deformity of the parts. Considerable loss of gland substance can be demonstrated on palpation, one or both lobes being much atrophied. A small chronic sinus opening into the urethra is sometimes a source of continued trouble: infectivity can in this way be kept up for several months.

*Prognosis.*—The onset of a prostatic abscess will give rise to anxiety until it bursts or is incised and

healing is established. Septic peri-prostatitis and phlebitis of the prostatic plexus of veins are said to give rise to fatal complications in 40 per cent of the cases in which they occur, but surgical intervention at the right time should eliminate much of the risk.

*Treatment.*—The surgical axiom that where pus is the knife should follow, is only applicable to a small proportion of the cases of prostatic abscess. The fact that the great majority of prostatic abscesses burst spontaneously into the urethra and heal thereafter as quickly and with much less discomfort to the patient than if they had been incised, negatives surgical intervention as a routine procedure.

Prostatic abscess is comparable to abscess of the tonsil with this difference, that opening into the former is a formidable operation and into the latter a very minor affair. Nevertheless cases occur where operation is advisable, and sometimes where it is necessary in order to save the gland from destruction if not to save the patient from death.

Operation being decided upon, by which route should the abscess be attacked? It does not solve the difficulty to say that incision should be made where the abscess points, otherwise this would mean the adoption, almost as a routine measure, of the procedure advocated strongly by Guiteras, viz., to incise the abscess through the prostatic urethral wall after performing perineal urethrotomy. In some cases it might mean puncture through the rectum. It would seldom suggest a direct perineal operation and drainage, and yet this is the most favoured, as it is perhaps the most surgically correct method.

The rectal is the easiest route by which to reach an abscess whose fluctuating cavity can be felt

through the rectal wall. Relief by puncture is not unlikely to be followed by speedy reaccumulation of the pus; incision of the rectal wall and blunt dissection into the abscess is therefore the procedure advocated by most of the supporters of this method. There are, however, three obvious objections to this operation, viz., the risk amounting almost to certainty of gonococcal infection of the rectal mucous membrane; the danger of rapid absorption of toxine; and the probability of introducing contaminating organisms to the abscess cavity.

In operating through the urethra, a perineal urethrotomy is first performed and the finger passed into the urethral canal locates the abscess where it points in the prostatic urethra. A sharp-pointed curved bistoury, four-fifths of whose blade is protected by a wrapping of gauze or cotton, leaving only the point free, is passed along the finger and a short incision is made into the abscess. Great care must be exercised to avoid cutting the external sphincter, otherwise incontinence of urine will result. Guiteras remarks that frequently the abscess will be found to discharge immediately on first opening into the posterior urethra, in which case no further puncture will be necessary.

The consensus of opinion is distinctly in favour of the direct opening into the abscess from the perineum in the great majority of cases in which operation is obligatory. The patient is placed in the lithotomy position, the rectum plugged with gauze, and if possible a large metal instrument is passed into the bladder to indicate the position of the urethra. A semicircular skin incision is made in front of and parallel with the external sphincter of the rectum. The incision is continued through the superficial fascia,

the perineal raphe, and ischio-rectal fat, until the anterior layer of the perineal fascia and the transversus perinei muscles are reached. The muscle is hooked forward and deep dissection proceeds, the anterior rectal wall being pushed backwards, and the bulbous urethra and Cowper's glands forward. Blunt dissection will suffice to separate the urethra from the rectal wall until the prostate is reached, and the abscess or abscesses thoroughly laid open and packed. Complete closure of the wound may be anticipated in six to eight weeks.

Macmunn recommends puncture of the prostatic urethra through the urethroscope with a specially constructed knife. In selected cases, with the patient under a general anæsthetic, this measure might be attempted by an expert urethroscopist.

#### CHRONIC PROSTATITIS

The potentialities of the chronically diseased prostate as a focus for recurring infections both of the patient and his consort, and as a disturber of the health in general, of the nerve balance and of sexual effectiveness in particular, have not received their due recognition from the medical profession. Overstatements of the case against the prostate have rightly received criticism; but, after all necessary allowances have been made for possible exaggeration, there remains the fact that much unhappiness and ill-health due to this cause is untreated and unrelieved because the crucial lesion is not diagnosed. When this question is better understood, rectal examinations will be a hundredfold more common than they are to-day. No consideration will deter either the physician or the patient when it is realised what

possibilities of relief are associated with proper diagnosis and treatment of the diseases of this important organ. A rectal examination in a genito-urinary case is not less important than a vaginal examination in a gynæcological case.

Chronic prostatitis may follow in the train of any of the acute forms of prostatitis and may last for years. Cases of chronic prostatitis may be separated into two divisions according to whether the symptoms are mild or severe. But the mild cases, after lying quiescent for longer or shorter intervals, are liable to exacerbations following alcoholic or sexual excesses, a debilitated state of the general health, exposure to cold or damp, or traumatism such as may occur from the passage of instruments or during horse-riding, bicycling, or gymnastics.

Subacute prostatitis in particular is likely to lapse into the mild chronic condition which may give little or no subjective indication of its presence. It is usually the observation in the urine of minute corkscrew filaments or comma forms that suggests an examination of the prostate, and enables this type of chronic prostatitis to be diagnosed. There is frequently some degree of chronic posterior urethritis accompanying the prostatic infection, but it may be slight and offer little symptomatic proof of its presence. Palpation in most cases will afford information of value. The examiner may gain an impression of hardness and shrinking of the gland suggestive of atrophic cirrhosis, but in the majority of cases some area of hypertrophy is found. Difference in the size of the two lobes is very suspicious. The surface may be either smooth or nodular.

Other symptoms which would attract attention to the prostate are functional disturbances of urina-

tion, e.g., feeling that the bladder had not completely emptied, or delayed or inefficient expulsion of the last drops of urine; functional disturbances of the sexual powers, e.g., impotence with increased desire; spontaneous discharge of prostatic or spermatic fluid while at stool, or spasmodic leakage of prostatic fluid due to loss of muscular tone. Chronic rheumatic pains are a frequent complaint in prostatitis.

*Character of the prostatic fluid in chronic prostatitis.*

—It is impossible to get uncontaminated prostatic fluid for bacteriological examination. The nearest approach to an exact method is to obtain the expressed secretion direct from the prostatic ducts through a urethroscope after a cleansing of the posterior urethra. The usual procedure, however, is as follows: The anterior urethra is washed out with boric solution. The reservoir of the irrigator is raised and the bladder is filled with the solution. The patient empties the bladder and the process is repeated with sterile water, but a small quantity, from one-half to one ounce, is retained in the bladder. The prostate is now massaged, and any secretion reaching the external meatus is caught on a slide. The patient finally empties the bladder completely, and the expelled fluid is centrifugalised or filtered and the deposit examined. If the patient can voluntarily expel the prostatic secretion from the posterior urethra it would be preferable to leave no fluid in the bladder, but only a trial in each case can prove which is the better plan.

Macroscopically, appearances suggestive of a diseased state are usually evident. Two or three purulent casts of prostatic ducts may be seen floating in the turbid solution. In addition to myriads of fine mucilaginous filaments and flakes many minute

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points or larger fragments of curdy pus are seen in suspension. If the contents of the seminal vesicles have been expelled along with the prostatic secretion they quickly settle to the bottom of the vessel and appear like translucent sago grains or, as Waelsch says, chloroform drops.

Microscopically, the diagnostic proof of disease is the presence of polynuclear leucocytes in considerable quantity. Many of these cells will be seen to contain lecithin. Amyloid bodies are scanty or absent. Many desquamated epithelial cells are present. Gonococci are very difficult to find in the secretion, as is to be expected, but their scarcity in the fluid does not prove their absence from the gland. If a smear could be obtained direct from the wall of an infected lobule they would probably be easily identified. If there has been a superinfection other organisms will be present.

*Sexual neurasthenia.*—As neurasthenic symptoms are so frequently associated with chronic prostatitis they require special consideration. That the neurasthenia is due to the diseased state of the prostate and that the prostatic complaints are not symptomatic of the neurasthenia is proved by the fact that satisfactory treatment of the prostate cures the neurasthenia. It may be suggested that treatment of any sort applied to any region of the body, so long as the patient's faith in the method can be sufficiently stimulated, will relieve the neurasthenia. This does not apply, however, to this particular class of neurasthenia. Until the prostate can discharge its normal functions, no amount of suggestion will be of any real benefit to the case.

Neurasthenia is but rarely an accompaniment of gonococcal infection of any organ other than the

prostate, therefore it is not a toxæmia. It is due either to interference with a proper supply of the internal secretion of the gland or is dependent on a chronic irritation of the complex nerve system of the organ. In addition to the symptoms of chronic prostatitis the nervous disturbances commonly present relating to the urinary system are polyuria, sudden imperative call to micturition, and a feeling that the bladder is never completely emptied. Phosphaturia is frequently present, and being mistaken for spermatorrhœa causes the patient much mental distress.

The perverted nervous feelings complained of include—feeling of alternate heat and cold accompanied by “clammy” sweating and particularly affecting the back and limbs, tinglings, rheumatic pains, neuralgia, neuritis, general debility, and mental depression.

Dropny states that he found indications of neurasthenia in 90 per cent of his cases of chronic prostatitis. He classifies them as follows :—

Sexual	.	.	.	.	.	46.9 %
Cerebo-spinal	.	.	.	.	.	43.8 „
Cardiac	.	.	.	.	.	4.3 „
Gastric	.	.	.	.	.	4.9 „

*Prognosis.*—In a few cases a large proportion of the gland is destroyed either as a result of abscess formation or of atrophic change. The desquamation of the epithelium and also the periglandular sclerosis lead to dilatation of the lumen of the tubules and ducts. There is seldom, however, such complete destruction of the essential glandular structures as to negative the hope of cure. In the great majority of cases the outlook is good, but treatment may have to be continued for a considerable time, especially

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in cases in which the colliculus seminalis is also involved.

### TREATMENT OF CHRONIC PROSTATITIS

The objects to be aimed at are the conservation of the remaining healthy gland tissue, the restitution of the affected epithelial areas, the destruction of the infecting organisms, and the maintenance of a free exit for the secretions.

The therapeutic measure most successful in attaining these ends is massage of the gland through the

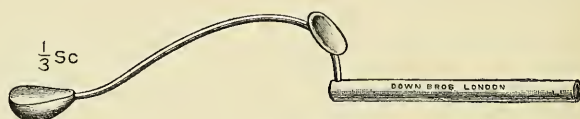


FIG. 58.

Watson's prostatic masseur.

rectum. This is most efficiently and safely carried out by the operator's rubber-protected forefinger, though by some the middle finger is preferred. Special instruments have been devised for the purpose, but these should only be used when the finger cannot comfortably encompass the gland, and in every instance their use has to be guided by a preliminary digital exploration.

Figure 58 illustrates the design employed by the writer in the rare cases in which the finger cannot satisfactorily complete the task. The whole posterior surface of each lobe must be systematically gone over, working from the lateral border to the urethral sulcus. The massage should be continued for two to three minutes, and should be repeated every second or third day. It should invariably be followed by urethro-vesical lavage, the most generally

useful solution being  $\frac{1}{2000}$  to  $\frac{1}{4000}$  nitrate of silver. This treatment, by the regular emptying of the lobules, prevents stagnation of the diseased secretion, and so discourages the formation of the duct casts seen as convoluted threads in the urine. It promotes the circulation in the gland and improves the tone of the musculature.

Vibratory massage has been recommended and may be used in suitable cases. There are several instruments specially designed for the purpose, one of the most satisfactory being Gunnsett's.

Electrical treatment is also warmly supported by some who have practised its application, and doubtless it is a useful adjunct in some cases.

The general treatment indicated is nerve tonics, such as glyccero-phosphates, strychnine, arsenic, iron, quinine, also outdoor exercise, but avoiding exhaustion. The exhibition of prostatic gland substance I have found beneficial especially in neurasthenic cases. It is, however, extremely difficult to get a sufficient supply of adult glands. The preparations in the market are obtained from lambs' prostates, and are therefore not so active. The interaction of the several glands known to furnish internal secretions suggests the use of thyroid, pancreatic, or hypophysis cerebri extracts. Thyroid is certainly helpful in a few cases.

That the treatment is acting beneficially is shown by a steady diminution in the number of pus corpuscles in the prostatic secretion, the reappearance of free lecithin granules, and the disappearance of gonococci. Complete absence of leucocytes will not be attained, and their presence in small numbers is compatible with health. Almost from the beginning of treatment the patients express themselves as

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feeling invigorated, and the subjective symptoms decrease in intensity until cure results, in the majority of cases within two or three months.

No case of gonorrhœa should be discharged as cured nor permission to marry be given to one who has had gonorrhœa until the condition of the prostate has been investigated.

## CHAPTER XII

### GONOCOCCAL VESICULITIS (SPERMATO-CYSTITIS)

THE vesiculæ seminales, on account of their situation near to and their direct communication with the posterior urethra, are liable to be invaded by the gonococcus, and this occurs with much greater frequency than is generally supposed. As in prostatitis, a rectal examination is necessary for its diagnosis, and as vesiculitis may be a cause of sterility and prolonged infectivity the possibility of its presence reinforces the argument in favour of rectal examination as a routine procedure in all cases of gonorrhœa.

*Anatomy and physiology of the vesiculæ seminales.*—The seminal vesicles are two diverticula from the vasa deferentia. They lie against the base of the bladder, and are separated from the second part of the rectum only by a layer of recto-vesical fascia. They extend upwards and outwards from the base of the prostate along the outer limits of the triangular area at the base of the bladder, which is uncovered by peritoneum. Their lower anterior ends lie near to each other and the mesial plane, but their bodies diverge widely as they proceed upwards, so that posteriorly they are separated by a considerable interval. Each lies to the outer side of the ampullated ends of the vasa deferentia and overlaps or passes to the outer side of the vesical insertion of the ureter (Fig. 59). The upper extremity just reaches the recto-vesical reflection of the peritoneum.

They vary as regards size in different individuals. The left one is not infrequently larger than the right. The average length is two inches (50 millimetres) and breadth half an inch (14 millimetres). Each vesicle consists of an irregularly sacculated and convoluted tube about five or six inches (10 to 15 centimetres) long, and it may be so bent on itself that its

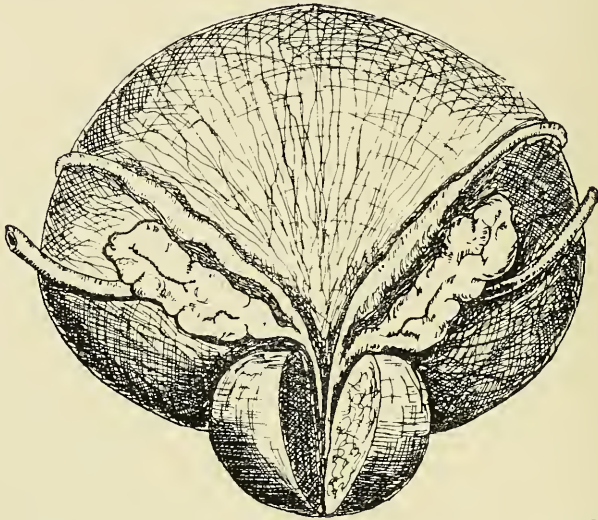


FIG. 59.

Diagrammatic view of bladder from behind and below, showing relationship between prostate, seminal vesicles, vasa deferentia, and ureters.

terminal cul-de-sac lies close to its lower end. From the main tubule several branches are given off, one of which may almost equal the primary tube in length. The convolutions are bound together by areolar tissue, and the whole organ is attached to the bladder by the recto-vesical fascia, beneath which ramify numerous branches of the prostatic plexus of veins. The vesicles have an outer covering of connective tissue, a middle coat of non-striated muscle

fibres, and a mucous membrane lined by cylindrical epithelium. The mucous membrane is thrown into folds, and numerous trabeculae give its surface a finely honeycombed appearance (Fig. 60). The short terminal duct of the vesicle unites at an acute angle with the vas deferens, the conjoined canal constituting the ejaculatory duct. The two ejaculatory ducts

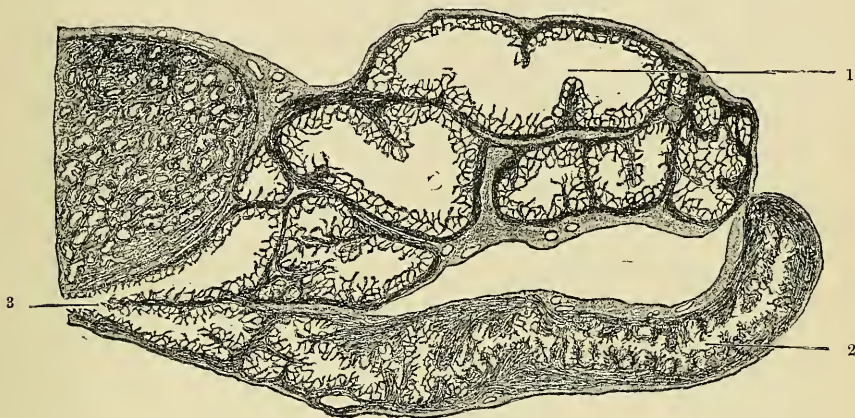


FIG. 60.

Showing the internal structure of the seminal vesicle and of the ampullation of the vas deferens, and the union of the two ducts which form the ejaculatory ducts: 1, interior of the seminal vesicle; 2, interior of ampulla; 3, junction of the ducts forming the ejaculatory duct. (The section is taken in transverse diameter of the prostate, and in the long axis of the seminal vesicles and vas deferens.) (Taylor.)

lying side by side enter the hilus of the prostate, which they pierce to reach the posterior urethra.

*Physiology.*—The function of the vesicle is imperfectly understood. By injecting fluids into the vas deferens the seminal vesicles are distended, and for this reason it has been assumed that the vesicles act as a reservoir for the storage of spermatozoa. That spermatozoa are found in the expressed secretion of the vesicles lends no support to this theory, because it is impossible to palpate the vesicles without at the

same time compressing the adjacent ampulla of the vas, whose function is the collection of the testicular secretion. On the other hand, the similarity in structure between the vesicula seminalis and the ampulla of the vas deferens suggests an identity of function.

In guinea-pigs, rats, and some other mammals, the vesicles have a separate and distinct duct, which communicates directly with the urogenital sinus, and they never harbour spermatozoa. The vesicles have therefore as another and probably more important function the production of a secretion which dilutes the semen and increases its bulk. It is suspected that this secretion favours the growth and activities of the spermatozoa, but no conclusive work on this subject seems to have been published. The secretion is alkaline and odourless. It contains numbers of characteristic heavy globules.

*Pathology and method of examination.*—When either of the seminal vesicles become infected the usual desquamative inflammation of the epithelium is induced. Gonococci penetrate into the subepithelial tissue, and round-celled infiltration and thickening of the wall occur. Leucocytes are extruded into the lumen of the tubules, where they become mixed with the altered secretion. The contents of the vesicle are then found to consist of a purulent, viscid fluid containing disintegrated or moribund spermatozoa epithelium and pus cells, micro-organisms, and serous exudation. The duct may become temporarily blocked and the vesicle greatly distended, in which case it will be felt, per rectum, as a sausage-like mass extending upward and outward from the prostate. When in a collapsed condition the seminal vesicle is hardly palpable from the rectum. Contained secretion can be

expressed, and as it settles rapidly to the bottom of the urine glass it can easily be pipetted. Examination may show micro-organisms, pus cells, and fragments of spermatozoa, and these indicate infection, even if enlargement is not demonstrated by palpation. To obtain the secretion as free from admixture with extraneous fluids as possible, it is necessary first to massage the prostate, carefully avoiding the vesicles, and thereafter to request the patient to pass a portion of urine to wash out the prostatic and urethral secretions. The vesicles are in turn massaged either by the finger or by an instrumental masseur, and on again passing urine the patient will expel the secretions which have been displaced from the spermatic cysts. From the bottom of the glass the material which has the appearance of sago grains should be chosen for examination and it should be searched for pus cells, gonococci, and spermatozoa.

Vesiculitis may be acute or chronic. Hyperacute cases and abscess formation are rare.

*Acute vesiculitis.*—The symptoms of acute spermato-cystitis are so involved with those of the accompanying posterior urethritis and prostatitis that a specific diagnosis from the subjective symptoms is impossible. The apposition of the vesicles against the trigone, the most sensitive part of the bladder, renders an inflammation of these sacs liable to excite aggravated urinary symptoms. Thus in addition to increased frequency of urination there is often a feeling of incomplete emptying of the bladder, because the bladder cannot fully contract. This is sometimes associated with terminal dribbling or suprapubic or deep perineal pain. Pain is sometimes referred to the inguinal and scrotal region, suggesting the onset of an epididymitis. During the acute period the

urethral discharge may be markedly decreased to return again as the acuteness subsides.

As a rule only one vesicle is affected, but at any time in the course of the disease the other may also become involved. Seminal emissions are frequently blood-stained and productive of extreme pain.

*Diagnosis.*—Vesiculitis may be inferred from the bladder symptoms and the sanguineous pollutions, but an exact diagnosis will depend on the discovery of an enlarged and tender vesicle by rectal palpation or on the microscopic demonstration of pus in the expressed secretion.

In the way of treatment there are no special indications other than have already been considered in previous chapters. All manipulative interference must be rigorously avoided in the acute stages. Atropine has here a particular value as a prophylactic measure against spread of the infection along the vas deferens to the epididymis. Hyoseyamus and phenacetin may control the vesical irritation, but if not, opium or its derivatives will be required. Hot irrigation through the rectal tube will be found very soothing.

*Course of the disease and prognosis.*—The great majority of cases of vesiculitis are mild or subacute. Hyperacute cases with perivesiculitis are rare. Abscess formation is seldom seen. When it does occur an exit is found through the ejaculatory duct into the posterior urethra, and only in very exceptional cases is any operative interference required. In ordinary cases resolution may be anticipated in two to three weeks, but there is always a tendency to lapse into the chronic form.

*Chronic vesiculitis.*—In chronic spermato-cystitis the symptoms are frequency of micturition, perineal

discomfort, sterility due to destruction of the spermatozoa, and painful sanguineous pollutions.

The walls of the chronically inflamed vesicles become thickened, and owing to fibrous changes and adhesions their contractile powers and control over their contents are decreased. The secretion may escape during any straining effort, and it may overflow during the night. In this way some cases of gleet discharge may be explained. The discharge in these cases if examined will be found to contain spermatozoa more or less disintegrated.

Insomnia and neurasthenia with polyuria may be induced by vesiculitis. Spermato-cystitis is usually associated with prostatitis, but the latter may resolve earlier than the inflammation of the vesicles. Subjective symptoms for the two affections cannot be separated, but rectal palpation and examination of the centrifugate from the urine after massage as already described will enable the true condition to be diagnosed.

Stricture is the scapegoat which has to bear the blame for all the symptoms produced by prostatitis and vesiculitis ; but there is little difficulty in recognising a stricture when it is present and in obviating its harmful effects. Once this has been accomplished, if symptoms still remain unrelieved, a systematic examination will in many cases discover a chronic vesiculitis or prostatitis or both.

*Treatment.*—The general health should receive every attention. The bowels are regulated by saline aperients, and such diet, exercise, and bathing enjoined as is suitable for the patient's condition. Urinary antiseptics such as urotropin, helmitol, salol, boric acid, and sedatives such as hyoseyamus, phenacetine, atropine, codeine, or morphine will occasionally be required.

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Coexisting conditions such as a posterior urethritis, stricture, or prostatitis should receive appropriate treatment.

*Massage of the vesicle* is of considerable value in the cure of chronic inflammatory conditions. Care must be used in the exertion of pressure to avoid any possibility of exciting irritation. The finger, well lubricated, will reach the vesicles beyond the prostate about  $2\frac{1}{4}$  inches from the anus, and it should follow the structure laterally and upwards to its limit, and then begin a gentle side-to-side and downward movement with the object of pressing out the contents of the sacs, softening the walls, and stimulating the circulation, thus promoting absorption and muscular tone. The patient adopts a slight bending posture, kneeling on a chair. The bladder should be fully distended to bring the vesicles well down into the pelvis. As a rule, I find I can reach the vesicles most comfortably with the palmar surface of the finger turned backwards, that is turned in the direction opposite to that which is adopted while palpating the prostate. In this case the nail or the extreme end of the finger is the pressing point. The massage should be repeated every two to four days, and each application should last from three to ten minutes. At first the amount of secretion expressed may be trifling, but as the cyst softens the quantity of detritus which may be expelled is often surprising. Sometimes what is evidently a cast of the vesicle is passed in the urine after massage. In addition to regularly repeated massage, electrical treatment is one of the most useful modes of attaining the same results.

The vesicles are not amenable to direct medication from the urethral canal, but Belfield has suggested and carried out a procedure which may in some

cases be of considerable value. His method consists in attacking the vesicle from the vas deferens in the spermatic cord, which he isolates with the finger and thumb and fixes by passing a half-curved needle through the scrotal skin and under the vas. Under local anæsthesia, a half-inch incision through the skin and sheath of the spermatic cord exposes the vas, which is then opened by a small transverse or longitudinal cut. The blunted needle of a hypodermic syringe will pass into the minute canal, and the chosen solution, not exceeding thirty minims in bulk to begin with, is injected, traversing the vas and ampulla and distending the seminal vesicle. A greater quantity than thirty minims is liable to excite painful contraction of the vesicle (spermatic colic). When it is desired to retain a fistulous opening for daily injections or for drainage of the ampulla, the vas is stitched to the skin by a fine suture passing through the wall of the vas on each side of the incision wound. When the course of injections is completed the fistula can easily be closed by suture. Belfield has proved by experiments on dogs, as well as by the after effects on man, that the lumen of the canal is not affected by this operation.

## CHAPTER XIII

### GONOCOCCAL EPIDIDYMITIS

EPIDIDYMITIS, in the vast majority of cases, is the product of gonococcal infection. Gout, influenza, tonsillitis, trauma, etc., may in occasional cases be responsible for the onset of an inflammation of the epididymis, but the usual cause is the conveyance of the gonococcus from the posterior urethra, via the vas deferens, either by direct extension of the inflammatory process or more probably by reversed peristaltic action. Tubercle is liable to attack the epididymis; syphilis is more prone to affect the testicle, as also is the rare inflammation associated with the infectious fevers.

Guiteras, who has had a large experience of these conditions, states that 85 per cent of epididymitis is gonococcal, 10 per cent tuberculous, and 5 per cent due to other causes.

By taking the average of several published statistics (Finger, Rollet, Jullien, Tarnousky, and others), Neisser estimated that 27 per cent to 29 per cent of cases of gonorrhœal infection in hospitals and 12 per cent to 17 per cent of cases treated as out-patients suffered from epididymitis. Neisser therefore adopts the mean of the above, 16 per cent, as the incidence of epididymitis.

This method of calculation is, however, of no value in attempting to determine the real incidence of

epididymitis, as a large proportion of cases of epididymitis seek treatment and only a small proportion of cases of urethritis. Only cases in which this complication has eventuated while the patient was already under observation should be included, and as such cases would all be undergoing treatment there would be no basis on which to calculate its occurrence in the great mass of untreated or insufficiently treated cases. Probably it would not be far from the actual facts to estimate the incidence at 6 per cent under suitable treatment, and a still higher ratio in untreated cases.

Epididymitis most commonly arises in the second, third, or fourth week of an acute gonorrhœa, that is to say, shortly after the involvement of the posterior urethra. It may, however, be excited at any time in the course of an acute or chronic infection located in the posterior urethra or its communicating cavities. It may be that the occurrence of the epididymitis calls attention to the presence of a previously unsuspected chronic infection.

Some individuals show an idiosyncrasy towards the development of an epididymitis. In such cases every attack of gonorrhœa is followed by this complication.

The right and left sides are affected with almost equal frequency. Very rarely are both concurrently attacked, but the one epididymis may become involved at a variable interval after the other. Walson found in one hundred cases the following dates of onset :—

Number of cases.	Previous existence of gonorrhœa.
6	1 week
14	2 weeks
6	3 „

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Number of cases.	Previous existence of gonorrhœa.
13	4 weeks
1	5 „
2	6 „
4	7 „
12	8 „
8	9 „
3	10 „
31	more than 10 „

Twelve of the above were recurrent attacks. As regards situation, forty-seven cases were on the right side and forty-five on the left side. In eight cases both sides were involved during the course of the gonorrhœa. These figures agree closely with those of other observers (Neisser and others).

*Anatomy.*—Towards the upper part of the posterior border of the testicle the efferent tubules (vasa efferentia), twelve to twenty in number, unite to form a single duct, the canal of the epididymis. This fine tube is disposed in a great series of convolutions. When these are unravelled the total length is found to approximate to twenty feet (6 metres). The upper bulkier part of the epididymis is known as the globus major, or head, the lower part as the globus minor, or tail, and the intervening portion as the body. From the globus minor the duct emerges with gradually thickening walls and widening lumen to form the vas deferens. The canal of the epididymis varies from .4 millimetre to .27 millimetre in diameter. It has thin walls with an external longitudinal and an internal circular layer of muscular fibres and an epithelial lining of ciliated columnar cells (Fig. 61). The cilia disappear towards the lower part of the epididymis. The globus major is attached

to the testicle by fibrous tissue, the vasa efferentia, and a reflection of the tunica vaginalis. The globus minor also is attached to the testicle, but only by areolar tissue and the tunica vaginalis. The globus major caps the postero-superior border of the testicle.

*The vas deferens* ascends upon the inner side of the epididymis at the back of the testicle. It accompanies the spermatic vessels and nerves in the sper-

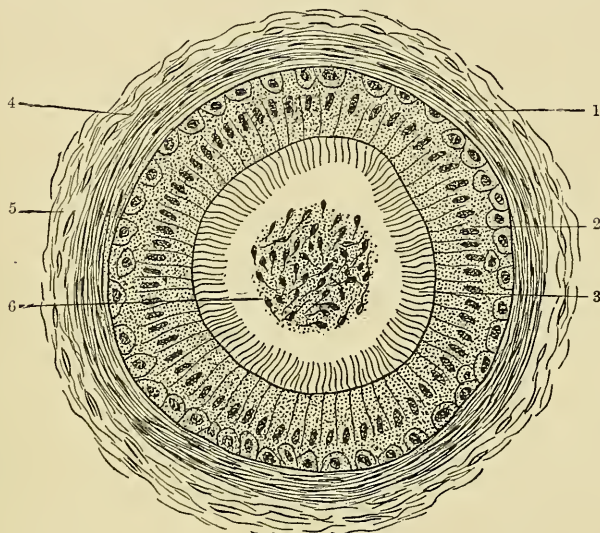


FIG. 61.

Showing section of a tubule of the human epididymis: 1, membrana propria; 2, columnar cells crowned with 3, long cilia; 4, layer of non-striped muscular fibres; 5, intertubular connective tissue; 6, masses of spermatozoa in the lumen of the tube. (Taylor after Pearsol.)

matic cord, where it can be felt like a piece of fine whip-cord. Leaving the spermatic vessels at the internal inguinal ring, it courses downwards over the side of the bladder to the base, where it becomes enlarged and sacculated to form the ampulla. Distal to the ampulla it again contracts, and uniting with the duct of the seminal vesicle constitutes the ejaculatory duct (Fig. 62).

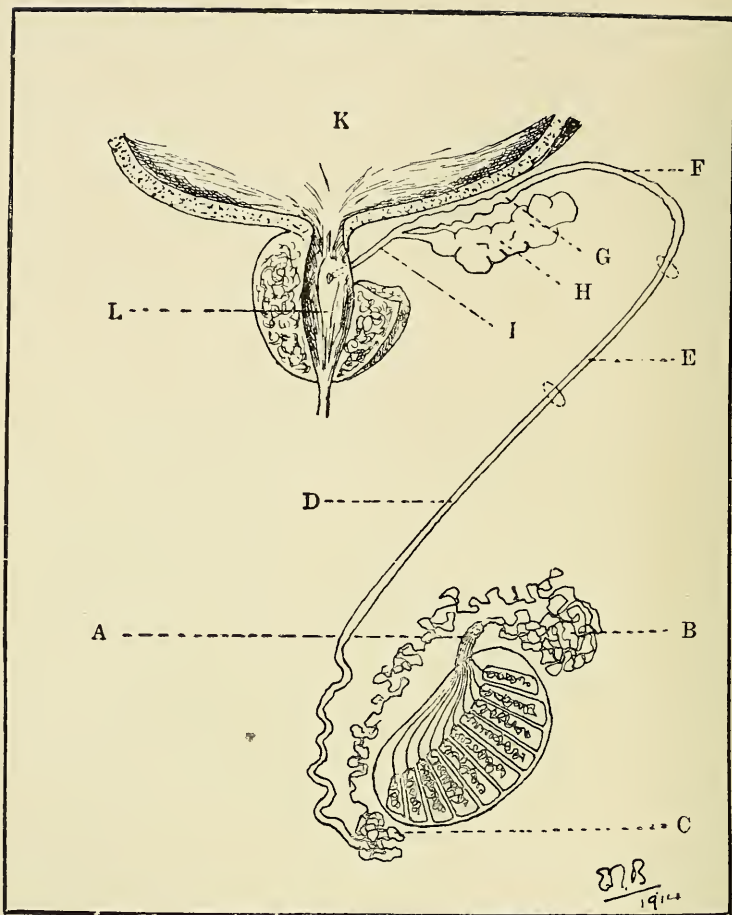


FIG. 62.

Diagram to show connection between prostatic urethra, seminal vesicles, and epididymis.

- A.—Vasa efferentia.
- B.—Globus major.
- C.— „ minor.
- D.—Vas deferens in spermatic cord.
- E.— „ „ „ inguinal canal.
- F.— „ „ „ abdomen.
- G.—Ampulla of vas deferens.
- H.—Seminal vesicle.
- I.—Ejaculatory duct.
- K.—Urinary bladder.
- L.—Prostatic urethra.

The vas measures about a foot in length (300 millimetres), and has an average diameter of 2·5 millimetres and a lumen of ·7 millimetre. The thickness of the wall is due to the quantity of muscular tissue. The epithelium is columnar, but not ciliated. The ampulla is very similar to the seminal vesicle in structure and appearance.

*Etiology.*—Fluid tapped from the inflamed epididymis usually yields the gonococcus in pure culture. The gonococcus reaches the epididymis from the posterior urethra or seminal vesicle by a reversed peristaltic action of the vas deferens. Low and Oppenheim demonstrated this fact by electrical stimulation of the ejaculatory duct of a patient recently infected with gonorrhœa. A vermicular movement of the vas deferens in the direction of the epididymis could be felt by the hand, and an acute epididymitis resulted from which the gonococcus was isolated. Schindler, by experiments on animals, showed that irritation of the prostate and colliculus seminalis initiated this reversed movement, and that by atropine such currents could be inhibited. A careful examination will usually prove that the seminal vesicle of the same side is antecedently or concurrently involved.

Bronium found the gonococcus in the secretion of the seminal vesicles of the affected side in 80 per cent of his cases, and in the other 20 per cent pus cells were present.

Exciting causes are trauma, irritation from excessive local treatment or passage of instruments, sexual excitement, and delay in emptying a full bladder. Any agency which will increase the intensity of the inflammation will tend to excite an epididymitis, hence the importance of avoiding all

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instrumentation in acute conditions and the adoption only of such treatment as will have a sedative effect.

Cases have been reported by careful observers (Neisser, Jadassohn, and others) in which the posterior urethra had been skipped by the inflammatory process. Such an appearance may be explained by the supposition that the gonococci, which reached the prostatic urethra, had been swept away by the urine stream, with the exception of a few which had been deposited in the orifice of an ejaculatory duct. An even more probable explanation is that the posterior urethritis at the time of observation was quiescent or cured, but that the gonococcus had secured a footing in the seminal vesicle. Infection of the epididymis by the blood stream is conceivable as part of a general infection, but in such cases there would be corroborative evidence in the way of joint or endocardial disease. If any cases of gonorrhœal epididymitis owe their origin to this source it must only be a fractional percentage.

A number of cases are on record in which epididymitis preceded the urethritis. These have been cases of relapsing gonorrhœa and not fresh infections.

*The vas deferens* may or may not show signs of inflammation (deferentitis, funiculitis). The tube of the vas is not necessarily acutely implicated in the gonorrhœal process. The transference of infected material from the posterior urethra to the epididymis is effected, as has already been shown, by a reversed peristalsis. While the ampulla of the vas is frequently involved concurrently with the seminal vesicle the tissues of the vas are more resistant to the action of the gonococcus, and therefore an acutely inflamed vas is comparatively uncommon. In this respect the vas is comparable to the mem-

branous urethra. Some tenderness of the cord may be elicited by pressure at the external inguinal ring some hours before the appearance of any scrotal swelling, and this is one of the initial symptoms suggestive of the onset of epididymitis.

*Pathology.*—The cauda epididymis, the most dependent part, is usually the first to show evidence of inflammation. The body and head are soon involved and the resulting swelling may be general, or more pronounced either in the upper or lower globes. The lateral surfaces, as well as the two poles of the testicle, are encroached upon by the enlarging epididymis. By following the groove between the overlapping epididymis and the invaginated testicle, it may be possible to form some idea of the size of the latter and thus to determine whether it is implicated to any extent in the inflammatory process (epididymo-orchitis). This, however, is quite unusual, the pathological condition being confined to the epididymis when the gonococcus alone is the infecting agent. There is usually some effusion into the tunica vaginalis forming a temporary hydrocele, and this increases the difficulty of delineating the structures.

A severe inflammatory reaction is induced in the connective tissue surrounding the convolutions of the epididymis. Exudation collects in the interstitial spaces; the lumen of the canal becomes occluded at various points by the pressure of this exudate, and pools of sero-purulent secretion containing leucocytes, desquamated epithelium, and gonococci distend the intervening portions of the tube. Small abscesses are a frequent result.

The hydrocele fluid in many cases is found to contain gonococci. In quantity it varies from a few

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drams to a few ounces. In a small percentage of cases the exudation becomes solidified, and the resulting fibrinous layer produces more or less adhesion between the parietal and visceral surfaces of the tunica vaginalis.

In nearly all cases there is some formation of false membrane on the surface of the epididymis. This is composed of fibrin, leucocytes, and cell detritus, and it closely resembles the exudate found on synovial membranes in gonorrhœal arthritis. A leucocytosis of over 30,000 may be present. Where a high leucocyte count is found, small abscesses are usually, but not always, present.

The scrotum in many cases is red, swollen, and œdematous: a brawny condition of the scrotum is most marked when there is little or no hydrocele effusion.

*Symptoms.*—An observant patient may notice inguinal discomfort and tenderness a few hours in advance of the first symptom referable to the testicular region. He will next be conscious of a sensation of burning at the postero-inferior angle of the testicle. Swelling and considerable pain are soon prominent symptoms progressive during the first few days until the affected side of the scrotum has reached the size of a closed fist. In acute cases the swelling increases rapidly, the scrotum becomes red and œdematous, fluid accumulates in the tunica vaginalis, and the whole mass is too tender to stand the manipulation necessary to outline in detail the confines of the testicle and surrounding epididymis. Lymphangitis is sometimes responsible for considerable pain along the course of the spermatic cord. The temperature may rise to 103° F. or 104° F., but fever is only present during the progressive stage.

The stationary stage is reached in three to five days, lasts about a similar period, and is followed by a slower resolution. As soon as the swelling reaches its maximum the extreme pain abates if the scrotum is properly supported. The pain may be intense; it is often of a sickening nature and liable to produce a feeling of faintness. In subacute cases the symptoms are similar but less severe; the duration of each stage is reduced by a day or two, and convalescence is, as a rule, more rapid and complete.

*Diagnosis.*—The medical attendant has first of all to satisfy himself that the case is one of epididymitis as against orchitis; and, secondly, that it is of gonorrhœal origin. The first is ascertained by questioning as to the point where the pain and swelling originated and the digital examination of the inflamed mass. The occurrence of an acute hydrocele may, when necessary, be demonstrated by a trochar. The gonococcal nature of the disease is proved by evidence of infection elsewhere, which, however, may have to be carefully searched for. The patient may attempt to suppress the history of a urethritis. A recently passed urine will, however, in most cases show threads and flakes of purulent secretion, and a rectal examination, conducted with the greatest gentleness, should be undertaken to determine the condition of the prostate, of the posterior urethra, and particularly of the vesicula seminalis of the corresponding side. The discharge of an acute urethritis often declines during the progressive stage of an epididymitis, and it may entirely disappear for a time, to return in most cases on the subsidence of the epididymitis. This phenomenon is probably dependent on the formation of antibodies in response to the quantity of gonotoxine entering the circulation

through the spermatic lymphatics and veins. The absence of external discharge may, in such cases, be apt to mislead, but a scrutiny of the urine will prevent misconception.

Tubercular epididymitis is distinguished by its slow development, by the fact that it originates most frequently in the globus major, and by the presence of tubercular disease in other parts of the genito-urinary system, e.g., the vas deferens, seminal vesicles, prostate, or trigone of the bladder. Tuberculosis of the vesicles and prostate is characterised by the occurrence of small scattered nodules which, on palpation through the rectum, are found to be hard and practically free from tenderness. In acute orchitis due to metastatic infection or to mumps, the inflammation is limited to the testicle itself; there are no threads in the urine, and there is no perineal discomfort.

*Prognosis.*—The more severe cases are usually retrogressing and able to be out of doors within the fortnight, but complete resolution may take several weeks longer. When the parts finally have returned to their normal appearance, careful palpation will frequently show the presence of a chronic nodular infiltration in the substance of the epididymis. These nodules may be found either in the globus major or minor. They usually indicate complete obstruction of the canal and sterility as regards the testicle concerned. Should the nodule be situated in the globus major above the point of entrance of any of the vasa efferentia, only partial deprivation of spermatozoa will result. If epididymitis has affected both sides, and nodules are left, complete sterility may be anticipated. This, however, does not entail impotency; sexual desire and power are unimpaired,

but the ejaculated semen, although apparently normal, is entirely deficient in spermatozoa. Benzler collected the paternity statistics of a number of German ex-soldiers who, while serving with the colours, had contracted gonorrhœa. He found that three years after marriage 10·5 per cent of those who had suffered from gonorrhœa without epididymitis were childless, while 23·4 per cent of those with unilateral epididymitis were sterile, and 41·7 per cent of those who had been affected with double epididymitis had no children. Keyes points out that liability to relapse presupposes a patent canal, and therefore freedom from sterility; but this cannot be accepted as an absolute rule, as the canal may be blocked at a point high enough to prevent entrance through the vasa efferentia of any spermatozoa, and yet leaving a considerable length of tube freely accessible to infection from below.

*Treatment.*—Prophylaxis is best served by the scrupulous observation of gentleness in treating the posterior urethra, by the use of atropine in sufficient doses as suggested by Schindler, and by the application of a suitable suspensory bandage.

Complete rest in bed is desirable in all cases of epididymitis, at least during the progressive stage. Ambulatory treatment has to be conceded for personal reasons in some cases, but it entails greater suffering and delayed cure. The main indications are the relief of pain and the reduction of the swelling, and these results are best obtained by rest and elevation. In recumbent cases elevation can be secured by means of a platform of broad adhesive plaster stretched across the thighs for the support of the scrotal contents, but a properly devised suspensory bandage is preferable as it allows of greater freedom

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of movement. In ambulatory cases some form of suspensory bandage is compulsory. The old-fashioned commercial suspensory is of little use, but some of more recent introduction are satisfactory, e.g., Johnson and Johnson's Red Cross Athletic Bandage. A combined T and triangular bandage may be improvised for the support of the parts from an ordinary triangular bandage with a forty-inch base in the following manner. A two-inch strip is cut along the base of the bandage up to two inches from its centre on each side, leaving a waistband with a four-inch attachment to the base of the now smaller triangle. Similar or somewhat narrower strips are slit along the sides until within two inches of the apex. The basal strips are tied round the waist, the padded scrotum hoisted snugly within the reduced triangle, which is then attached firmly to the waistbelt behind by means of the lateral strips. An opening is cut at a suitable point for the escape of the penis. The scrotum is surrounded by a layer of cotton-wool or gauze saturated with whatever dressing has been prescribed. This is covered by a sheet of oiled silk, and the testicle hoisted well up before applying the perineal bandage (Fig. 63). A small triangular bandage may also be used in a reversed manner by attaching to the centre of the base a strip of tape or bandage with which it is fixed to a waistband posteriorly. The base of the triangle (fourteen inches long) should be placed under the scrotum, the ends brought up on each side in the groin and tied to the waistband. Any loose folds are then bunched together and with the apex pinned to the waistband in front. Cotton-wool and oiled silk should always envelop the scrotum beneath the supporting bandage.

For the relief of pain the remedy in most general

use is moist heat in the form either of fomentations or poultices. Cold has been much used on the Continent, but it is not so comforting, and the prolonged use of an ice bag by devitalising the tissues is not without risk. It is now recognised that the tendency to nodular remnants is increased by the cold method of treatment.

Guiteras advises the use of the Paquelin cautery for the relief of pain in cases which have to be treated

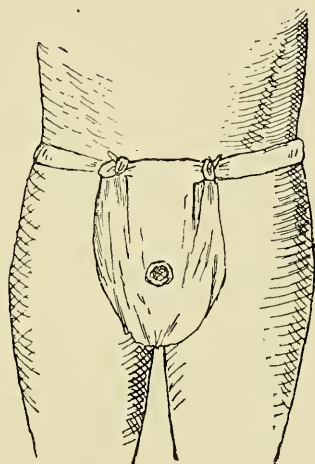


FIG. 63.

Application of the modified triangular bandage.

without confinement to bed. As I have no experience of the method, I will give his description verbatim. "We grasp the affected testis in the left hand to steady it, and then brush the cautery blade at white heat lightly over the surface of the scrotum in quick sweeps, just grazing the skin. This is done in several places, leaving reddish stripes as the evidence of the cautery application. The effect of such treatment is often incredible, and I have at times seen patients come limping into the hospital apparently suffering

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most excruciating pain, who were almost immediately relieved of their pain by the application of the cautery."

*Local external applications.*—Many remedies have been recommended for application to the scrotum. Amongst those which have attained the greatest vogue are ichthyol in glycerine (10 to 50 per cent), guiacol in spirit, glycerine or vaseline (10 to 15 per cent), and extract of belladonna in glycerine (10 per cent). The most satisfactory of these is a 20 per cent solution of ichthyol in glycerine applied, when the fomenting stage is past, on lint covered by oiled silk and supported by cotton-wool inside a suspensory bandage. As an alternative, one of the menthol and salicylic acid lanoline pastes or one of the infusorial earth and glycerine preparations such as antiphlogistine might be used. Guiacol is liable to set up dermatitis, while belladonna absorption may give rise to symptoms of poisoning, especially if atropine is at the same time being administered internally. Absorption through the scrotal skin takes place with great facility.

Leeches were at one time largely employed, but in such a vascular part the resulting hæmorrhage may be troublesome and difficult to control. Strapping of the testicle is frequently used, but it is difficult by this method to maintain any satisfactory constant pressure. When compression is desired to assist absorption, a short elastic bandage fixed by adhesive plaster is preferable.

The Bier method has been extensively employed, and favourably reported upon. The passive hyperæmia is induced by a constricting rubber tube or bandage applied over a layer of cotton-wool in such a manner as to include only the affected side of the

scrotum (Fig. 64). The amount of pressure to maintain is regulated by the subjective sensation of the patient. The constricting band is kept in position for one hour at the first application. The duration of the treatment is doubled each day until a period of eight hours is reached. This method is not suitable in general practice, as it requires the constant attention of a skilled nurse, but in hospital I have found it of decided value.

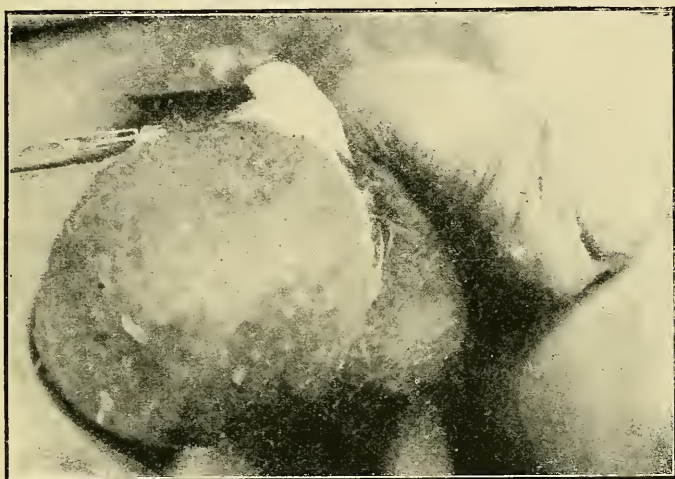


FIG. 64.

Epididymitis and paraphimosis. Bier treatment of epididymitis applied.

*General treatment.*—The diet should be suitably restricted. The bowels should be cleansed with a brisk saline aperient each morning. It is usually recommended that all local treatment of the posterior urethra and its adnexa should be discontinued for the first week at least. When it can safely be resumed it is limited to urethro-vesical irrigation with mild and warm solutions such as 1:8000 permanganate of potash; but it is a safe practice to rely solely on

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internal medication until complete subsidence of the epididymitis has been secured. Sitz baths twice a day are of considerable value; tincture of aconite and antimonial wine are old-time favourites now seldom prescribed; opium or its derivatives may be required to relieve pain and induce sleep if phenacetine is not sufficient for this purpose. The rôle of vaccines in epididymitis is considered in the special chapter devoted to vaccine therapy.

*Operative treatment.*—Several operative measures have been advocated with the object of aborting the epididymitis or of decreasing the liability to chronic nodular infiltration. Simple puncture was practised by Perigoff in 1852, Velpeau in 1854, and others. Henry Smith in 1864 published in the "Lancet" a report of several cases of gonorrhœal orchitis treated by puncture with a fine bistoury. On account of septic complications the method speedily lost favour, and was evidently lost sight of until revised in a modified form by Baermann in 1903. He uses a glass syringe with a fairly large needle, and punctures the whole length of the epididymis. During withdrawal he aspirates with the syringe. This operation gives considerable relief in many cases by reducing tension, and possibly by evacuating small abscess cavities. Schindler is a strong advocate of this measure. He uses a needle such as is used for mercurial injections. He states that he finds the operation simple and but slightly painful; that pain, tension, and fever are immediately relieved, and that the duration of the disease is reduced by half. The objection to this mode of treatment is the risk of injury to the fine canal of the epididymis and consequent sterility on the respective side. The supporters of this method affirm

that there is much greater risk to the tube from the uncontrolled inflammation than from the puncture. However, it is necessary to consider whether the beneficial effects cannot be obtained by some other means while avoiding danger to the continuity of the canal. With this in view, Neisser suggested to Bruck the making of a small incision (1 centimetre) through the coverings of the epididymis over the globus minor. He adopts cocaine infiltration of the spermatic cord only in occasional cases. The scrotal skin is disinfected with tincture of iodine, and the incision made with a fine-pointed bistoury for a distance not exceeding 1 centimetre. While pushing the affected epididymis towards the knife the tunica communis and propria are slit to a length of about 1 centimetre. The wound is painted with tincture of iodine and dressed with gauze and zinc plaster. Bruck says: "The effect is as prompt as with the needle puncture, the epididymis itself is not hurt or only in the most peripheral parts, and no complications have ever been observed to follow this procedure."

This simple operation seems to require slight modification to avoid if possible the risk of injury to the "most peripheral parts" of the epididymis. For instance, a minute superficial incision might be made in the fibrous coat of the epididymis, just sufficient to allow of the insertion of a small director on which the further incision of the capsule might be made; or a small pair of scissors might be used for the purpose with less risk of injury to the essential structure of the organ, the convoluted canal of the epididymis.

*Injection of a colloidal silver preparation*, "Electrargol," into the substance of the epididymis is

recommended by Asch. He uses a fine needle and injects .5 to 1 cubic centimetre of an isotonic solution of an electrically prepared silver colloid. It has usually been found that in addition to the pain of the puncture the instillation of the fluid, by increasing the tension, causes a marked increase in the pain for one or two hours. Thereafter the course of the acute stage is modified for the better, but the ultimate result as regards permanent infiltration is even less satisfactory than when purely expectant treatment is adopted.

*Epididymotomy.*—More extensive surgical interference was suggested by Belfield in 1905 in an article entitled "Pus Tubes in the Male." He advised an incision one inch long into the epididymis and the suturing of the skin and tunica edges together. In 1906 Bazet reported several cases operated on during the previous nine years. He cut down on the epididymis along the line of the ligamentum scrotale, thus avoiding the cavity of the tunica vaginalis.

In the same year Hagner independently elaborated an operation for severe cases of epididymitis, for which he has now gained wide acceptance in the United States. Much of our knowledge of the pathology of the condition is due to Hagner's work. He states that visible pus was present in 80 per cent of his cases, but in this connection it should be remembered that he only operates on the more acute cases. Describing his technique, Hagner says: "At a point over the juncture of the epididymis and testicle an incision 6 to 10 centimetres long is made through the skin and parietal layer of the tunica vaginalis. After the serous membrane is opened all the fluid is evacuated and the enlarged epididymis examined through

the wound. The testicle, with its adnexa, is delivered from the tunica vaginalis and enveloped in warm towels. The epididymis is then examined and multiple punctures made through its fibrous covering with a tenotome, especially over those portions where the enlargement and thickening is greatest. The knife is carried deep enough to penetrate the thickened fibrous capsule and enter the infiltrated connective tissue. When the knife is through the thickened covering of the epididymis a very marked lessening of resistance will be felt. If pus is seen to escape from any of the punctures, the opening is enlarged by incising the connective tissue covering the epididymis, care being taken not to wound the tubules. A small probe is inserted from which the pus flows, then by a backward and forward motion of the probe the opening is enlarged and the pus allowed to escape. By this method I believe there is less danger of injuring the tubes of the epididymis than by cutting with a knife. After the probe has been passed in pus will be evacuated by light massage in the region of the abscess, and a finely pointed syringe is used in washing out the cavity with a 1:1000 bichloride of mercury, followed by a physiological salt solution. The testis is then restored to its normal position, and in every case the tunica vaginalis is thoroughly washed with 1:1000 bichloride, followed by normal salt solution. The incision of the tunica vaginalis is lightly closed with a running catgut suture; a cigarette drain of gauze is then passed through the lower angle of the incision in the tunica vaginalis down to the epididymis, the skin being brought together by a subcutaneous silver-wire suture, the cigarette drain passing out at the lower angle of the wound. Silver foil and a sterile dressing are now

applied and the part supported by a T bandage or suspensory."

The relief of pain is complete and immediate following this operation. Its supporters maintain that the duration of the disease is reduced, and the ultimate results more satisfactory, especially as regards occlusion of the canal and sterility. If therefore all risk of sepsis could be entirely eliminated there would be much to recommend this, the most heroic of the surgical methods of dealing with the acute type of epididymitis.

*Epididymo-vasotomy*.—For the cure of sterility dependent on chronic nodular infiltration or permanent occlusion of the canals of both epididymes from any other cause, Martin has introduced an operation which has met with considerable success in selected cases. It is an attempt to procure an anastomosis between the epididymis at a point above the site of the constriction and the vas (epididymo-vasotomy).

Cases are only ready for operation when the rest of the genital tract has been cleared of obstruction and infection. Martin recommends that the surgeon should assure himself of the patency of the vas by the preliminary performance of Belfield's operation, using twenty to thirty drops of a watery solution of an inert colouring matter; the vesicle and ampulla are massaged and the colour should then show in the urine. Another necessary precaution is to demonstrate the presence in the fluid removed from the testicle by a hypodermic syringe of normal motile spermatozoa. The anastomosis is obtained by suturing together the edges of an oblique incision in the vas at the level of the head of the epididymis directly to an oval opening made in the globus major. The

epididymis is approached from a posterior scrotal incision, and if the veins are carefully avoided little or no hæmorrhage may be anticipated.

*Belfield's operation*, mentioned above, was suggested for irrigation and drainage of the seminal duct and vesicle through the vas deferens. The vas is isolated by the fingers from the other structures of the spermatic cord, pressed against the scrotal skin and fixed by passing a curved needle behind it. Under local anæsthesia, a half-inch incision is made through the skin and coverings of the spermatic cord, the vas is exposed, and a small opening is made into the canal. A blunted hypodermic needle will pass into this minute channel, and a watery solution, to the extent of 20 or 30 minims, of any desired agent may be injected. The fluid will pass along the vas and distend the seminal vesicles. To maintain a fistula for continued treatment, the edges of the vas incision may be stitched to the skin wound.

Belfield states that by this method not only can chronic infection of the vesicles be rationally treated, but an impending epididymitis may be aborted or recurring attacks prevented. The wound is closed by suture when healing is desired.

Speaking generally of surgical interference in epididymitis, it can require consideration in but a small proportion of cases, and should only be ultimately adopted in a selected few. Operative treatment should not be lightly undertaken in a condition which tends to spontaneous cure, where aseptic surroundings are difficult to procure and maintain, where antiseptics, on account of the sensitiveness of the scrotal skin, have to be employed cautiously, and where exact procedure is impossible on account of the fineness of the convoluted canal.

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It is evident that more harm than good may follow haphazard interference, and that operation in any given case should only be undertaken after careful consideration, but nevertheless surgery has here a legitimate, if limited, field of usefulness.

## CHAPTER XIV

### GONORRHOEA IN THE FEMALE

IMPORTANT as gonorrhœa in the male undoubtedly is, gonorrhœa in the female is even more serious as regards its remote effects. The anatomical arrangement of the female genito-urinary tract favours the upward growth of the gonococcus by continuity of surface. The monthly recurrence of menstruation and also the puerperal state are propitious periods for further extension of gonorrhœal infection, and it is following these conditions that an acute attack of tubo-ovarian or pelvic inflammation frequently asserts itself.

While the surgical aspects of some of the effects of gonorrhœal infection of the genito-urinary tract bulks largely in modern text-books of gynæcology, the subject is seldom approached in its proper sequence, and practically never in its proper perspective. The older text-books devoted insufficient space to gonorrhœa in the male, but absolutely insignificant space to the same disease in the female. This neglect was largely due to the difficulty of differentiating between what was thought to be leucorrhœa and the true infective gonorrhœa, as well as failure to appreciate its significance as a cause of pelvic inflammation. The discovery of the gonococcus was not immediately followed by a marked change in this respect, owing to the greater difficulty experienced in isolating the organism from the discharge of female patients.

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West, Bernutz, and Goupil about the middle of the last century made passing reference to gonorrhœa as a possible cause of tubal and pelvic inflammation, but little notice was taken of the suggestion by subsequent authors. West (1856), speaking of the upward spread of gonorrhœal inflammation, says: "The tendency of inflammation of the uterine mucous membrane to extend along the Fallopian tubes and to attack the peritoneum is much stronger than to affect the substance of the organ, and although abscesses sometimes form as a secondary result of the disease, they are almost always situated in the pelvic cellular tissue or within the folds of the broad ligament, and scarcely ever in the interior wall itself."

Much discussion has ranged round the question of the incidence of gonorrhœa in women, and also as to the comparative frequency of its occurrence in women as compared with men.

Noeggerath in 1872 wrote forcibly on this subject, and provoked a storm of discussion. His work was, of course, unsupported by bacteriological proof, and he considerably overstated his case. He postulated that 80 per cent of men acquired at least one acute attack of gonorrhœa, that gonorrhœa was an incurable disease, and that the wives of these men invariably became infected. He concluded therefore that approximately the same percentage of women as of men were the subjects of gonorrhœal infection. While much of the pioneer work which Noeggerath accomplished on the subject of chronic gonorrhœa is now the accepted teaching, it is recognised that his estimate of the frequency of gonorrhœa in women was excessive, but so much discrepancy still occurs in the estimates of different observers that little purpose can be served by reproducing them here. Suffice it to say

that while there is not the same latitude for increased incidence among males, the percentage of affected females is steadily increasing, and is likely to continue to do so until the question receives the serious consideration and attention from the State which its gravity demands.

*Anatomical data.*—Only such anatomical and physiological questions as have some bearing on the progress of gonorrhœal infection will be considered.

The *urethra* in the female is a musculo-membranous canal, 3 centimetres in length and 7–8 millimetres in diameter. So elastic are the walls that it can by gradual dilatation be distended to 2·5 centimetres or more, admitting of the index finger without incontinence of urine resulting. The walls are 0·5 centimetre in thickness. From the internal or vesical orifice the urethra passes through the bladder wall (intramural portion), runs a short course (the superior or free portion) until it enters the vaginal wall (the inferior or vaginal portion) and terminates at the external or vestibular orifice. Except during urination the walls are in apposition. The mucous membrane is thrown into longitudinal folds so that a transverse section shows a stellate closure. These ridges are not entirely obliterated by distension of the urethra, one fold in particular being prominent on the lower or posterior wall. The epithelial lining is of the stratified squamous variety, but towards the bladder it becomes transitional. It is pierced by numerous lacunæ and also by tubular glands, which secrete a colloid material, and are homologues of the prostatic tubules. These are especially numerous in the region of the external meatus, where a group on each side empties into a special efferent duct (Skene's ducts). These ducts vary in length from 1–2 centi-

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metres, and lie beneath the mucous membrane in the muscular coat. They run parallel to the long axis of the urethra, and their orifices will be found to be 2–3 millimetres inside the external meatus, unless the latter should be patulous, in which case the openings of the ducts may be seen on each side of the urethra on separating the labia. They are sufficiently large to admit of the passage of a number one probe (French scale). The distal ends of these ducts may divide into several branches.

*The mucous membrane of the vulva* is covered by a scaly epithelium, and is provided with numerous mucous crypts or follicles as well as a large number of sebaceous and other glands.

*The glands of Bartholin* correspond to Cowper's glands in the male. They measure from 1–2 centimetres in their longest diameter, and their ducts open one on each side of the vaginal introitus in the groove between the attached border of the hymen and the labium minus.

*The mucous membrane of the vagina* is covered by stratified scaly epithelium, and possesses great numbers of microscopic papillæ, but only exceptionally any glands.

*The mucous membrane of the cervix* is closely adherent to the subjacent tissue, and is sharply defined from that of the body of the uterus. In the lower portion of the cervical canal the epithelium retains the characteristics of the vaginal mucosa, being of the stratified squamous variety and possessing no glands. In the upper portion the epithelial layer is ciliated, and is pierced by the ducts of numerous tubular and acinous glands.

*The mucous membrane of the uterus* is a soft spongy stratum, 1 millimetre thick in the intermenstrual

period. It is covered by a layer of columnar ciliated epithelium, and contains many long convoluted tubular glands, which extend throughout its whole thickness, and sometimes penetrate between the fibres of the subjacent muscular tissue. These glands are also lined with ciliated epithelium.

According to Young, the uterine mucosa is a soft protoplasmic mass imperfectly differentiated into cellular elements. The supporting network consists of branching cell processes, and these are more of the nature of films than filaments. The blood-vessels are constructed of flattened stroma cells unsupported, except in the deepest layers, with any specialised coats.

This "structural peculiarity," says Young, "is obviously designed for the purpose of permitting with the greatest possible efficiency an immediate flushing of any part of the stroma with a plentiful supply of blood."

*Menstrual changes.*—Preceding the onset of menstruation there is formed in the protoplasm of the mucosa a colloidal or crystalloidal substance which has an active affinity for fluids. The resulting imbibition of fluid from the blood-stream produces an acute engorgement of the tissue with œdematous infiltration: the cells of the blood-tracts are separated, and the way is prepared for the escape of blood-cells and plasma. These changes are under ovarian control, and are probably due to some bio-chemical substance of ovarian origin (secretion or hormone) which reaches the uterus through the blood-vessels.

Bland Sutton, from an examination of human uteri during menstruation, found that there was desquamation only of small and superficial areas of the epithelial lining. Stephenson has demonstrated

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a cycle of metabolic phenomena associated with the menstrual flow. For one to two days preceding menstruation there is an average rise of half a degree in the temperature, the excretion of urea reaches its maximum, the pulse rate is accelerated and the arterial tension is increased. During the period there is a return to the normal, and following the cessation of menstruation a subnormal level is reached.

Early in the menstrual period there is a general turgescence of the pelvic organs, but as the flow becomes established the vascularity diminishes, the uterus softens, and the cervix dilates.

*The Fallopian tubes* communicate with the cavity of the uterus through very minute orifices, which in the normal condition will hardly admit of the passage of a bristle. The mucosa of the tube is lined with ciliated epithelium, the cilia acting in the direction of the uterus. The mucous membrane is thrown into a series of longitudinal folds, which are obliterated on distension of the tube.

*The lymphatics* of the vagina drain, according to Waldeyer, in three directions. Those of the lower section join with the lymphatics of the vulva in passing to the inguinal glands; the middle portion is connected with the glands of the hypogastrium, and the plexus of the upper part unite with the lymphatics from the uterus, which pass through the broad ligament to the external iliac glands.

*The secretion of the uterus* is slightly alkaline in reaction, and contains a considerable amount of mucus derived from the cervical and uterine glands.

The vagina being without glands secretes merely a serous fluid containing some leucocytes and epithelial debris. In reaction it is acid (.945 per cent), and it gains this property from the lactic acid activity of the

bacillus of Doderlein. Zweifel suggests that in addition to the free lactic acid in the vagina, there is a proportion in combination with a base probably sodium. Antiseptics decrease the acidity by destroying or inhibiting the vaginal bacilli. Doderlein and Zweifel point out that in douching with tap water the lactic acid becomes fixed by combining with the bases in the water, while following the use of distilled water the lactic acid is rather increased.

During menstruation and also during the puerperium this acidity is lessened if not abolished, and infection of the uterine cavity is therefore more prone to occur at these periods. Any condition of health which markedly increases the uterine and vaginal secretion and thus produces dilution of the acid content of the vagina is also a factor favourable to the spread of infective processes. A slow stream conduces to the formation of acid and vice versa.

*Clinical signs of gonorrhœa in the female.*—The symptoms of the onset of gonococcal infection in women are in many, probably most, cases, not such as to cause much inconvenience, and only in a small percentage of cases is the patient impelled to seek medical advice in the early stages of the disease.

In women of cleanly habits the discharge usually gives rise to but little irritation, and vaginal discharge is of such common occurrence that it attracts little attention, especially when an antiseptic douche is part of the toilet; for although douching is valueless as regards reduction of infectivity or as a preventative of upward extension of the disease, it controls the gross symptoms. Some cases, however, run an acute course from the beginning, and the inflammatory reaction may be so severe as to confine the patient to bed. This type is most common in un-

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married girls and in newly married or in pregnant women.

The parts most subject to primary gonococcal inflammation are, first, the cervix; second, the urethra; and, third, the Bartholin glands.

*The cervix* is of outstanding importance as an original site of the disease. It is inoculated in nearly all infections of adults, and in the few cases in which the urethra is infected in the first instance, the cervix is soon implicated and becomes the main source of danger. The picture presented by a recently infected cervix is one of acute catarrhal inflammation. The mucous membrane is swollen and dull red. Pus is seen exuding from the os externum. The cervix bleeds readily, and the manipulation necessary in examining causes pain.

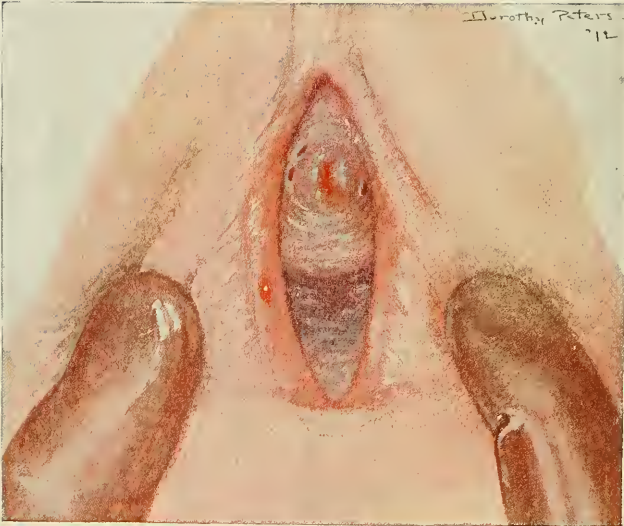
*The vagina* is not a locus of gonococcal activity, but it becomes irritated and sometimes inflamed by the action of the gonococcic secretion pouring over it from the cervix. The vaginal secretion is increased, the vaginal bacillus inhibited, and the lactic acid reaction reduced.

*The vulva*, like the vagina, is affected by the irritating properties of the discharge and may become inflamed and œdematous. The labia minora and the clitoris may be much inflamed, and a permanent hypertrophy may result.

Para-urethral passages are of frequent occurrence in the female, as also are blind pockets on the inner vulvar surfaces. One very constant pocket is found on each side of the urethra close to the smaller labial fold. These passages and pockets, as well as the ducts of any of the vulvar glands, may become infected, and if overlooked, they may remain the source of a chronic infection. When implicated, the orifices



## PLATE X.



### URETHRITIS AND BARTHOLINITIS.

On retracting the labia, the external urinary meatus appears as a reddened, elevated area. The mucosa is thickened and more or less everted. This is especially noticed in the labia of the urethra. The exit to Bartholin's gland on the right side is reddened, and presents the typical appearance of a gonococcal macule. A small drop of pus is seen exuding. As a result of the irritating discharge, the vulvar orifice is seen to be more or less inflamed. The infection of the crypts about the urethra is well illustrated. [Norris.]

appear as minute reddened spots projecting slightly beyond the mucous surface. The glands are frequently involved in groups, when a small patch of redness will indicate the area requiring special treatment.

*The glands of Bartholin* are frequently affected. The orifices of their ducts will then appear as two reddened areas lying in the grooves between the attached borders of the hymen and the posterior extremities of the labia minora. A cystic abscess may be induced by inflammatory closure of the duct.

*The urethra* is inoculated sooner or later in the majority of cases (80 per cent). The urethritis is rarely so acute as to cause much discomfort. Even when pus is seen exuding from the urethra and the lips of the meatus are coated, œdematous, and reddened, there may be no difficulty in voiding urine nor sensation of scalding. There is, however, some tenderness on pressure, and therefore coitus is painful.

In order to see the appearance of a urethritis at its worst, the patient must be advised to refrain from micturition and from cleansing the parts in any way for some time previous to the examination. The neglect of this precaution explains why the disease in the urethra is so frequently overlooked.

When the meatus looks normal and no pus presents there, it may be possible by digital pressure along the course of the urethra in the anterior vaginal wall to express a droplet of pus. When the secretion is scanty, as in the later stages of a urethritis, the only obtainable evidence of urethral infection will be from microscopic examination. Routine examination of urethral smears is necessary as a guide to treatment, and when this has been carried out in a series of cases the urethra has been found to be affected in over

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80 per cent of cases. The comparative freedom of the urethra from acute inflammation is due to the nature of its epithelial lining (squamous and transitional). The main sites of urethral infection are its glands and also Skene's ducts, whose minute openings are found just within the meatus at the junction of the posterior third with the anterior two-thirds of the urethral wall.

Gonorrhœal cystitis is not a common condition. The bladder epithelium resists the gonococcus, and unless its powers are reduced by injury or disease it can do so effectively. Certain small areas in the trigone are the parts affected when a cystitis is established, and these are seen through the cystoscope as minute red patches raised slightly above the surface of the surrounding healthy membrane. Gonococci can be obtained by swabbing these patches, and the nature of the lesion can thus be demonstrated.

The presence of the gonococcus in urinary sediment is not conclusive of gonorrhœal cystitis, but if large numbers of gonococci are found, probably a "urethrocystitis" is the underlying condition, the urethra with the above-mentioned areas in the adjacent trigone being involved in one inflammatory process.

The ureters, like the bladder, are not prone to attack, but several cases of kidney involvement have been reported.

### MODE OF INFECTION IN THE FEMALE

The usual mode of infection in the female is by direct transference of the infection to the genital canal during coition, but cases in which indirect infection is responsible for the onset of gonorrhœa are also found in practice.

*Direct infection* may be incurred from (*a*) a case of acute gonorrhœa, or (*b*) a case of chronic or recurring gonorrhœa. Most cases of infection in the female are caused by contagion from an apparently cured male. This is what so frequently occurs in early married life. The husband, presenting no symptoms of his former disease, seeks and obtains permission to marry from a physician, or relying on his own observations enters matrimony with an altogether false sense of security. It cannot be too strongly emphasised that a grave responsibility rests on the medical profession with regard to such cases. Some of the most expert and experienced specialists admit having wrongly consented to marriage with disastrous results, and they have therefore increased the scope of their inquiry and the thoroughness of their investigations.

No man who has suffered from gonorrhœa should marry until careful and repeated microscopic examinations prove the continued absence of the gonococcus from the anterior and posterior urethræ and from the adnexæ. In many cases it will be necessary to adopt some of the methods which stimulate any latent organisms which may be lurking in the glands or tissues into activity. Otherwise marriage itself may succeed in doing so, and a recrudescence of the disease occur with more or less reappearance of symptoms and an inevitable infection of the wife.

The gravity of this question is, in this country, not understood by the public and insufficiently appreciated by the medical profession. The "horrors" of such a situation require no writing up. Once any man realises that he is a potential source of actual and real danger he will surely leave no means untried to cleanse himself from the last traces of this disease.

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And now the medical profession is called on to undertake what may prove a difficult and tedious task. But cure can be attained in the end, and nothing less than complete success in the eradication of the gonococcus can satisfy.

*Indirect infection*, while it occurs in but a small percentage of the total cases, is not uncommon in practice, and it is not of such rare appearance as to be received with complete scepticism as an explanation of the occurrence of a gonorrhœa. The usual modes by which indirect infection is conveyed include (a) infected towels or linen, (b) water-closet seats or water, (c) instruments or douche nozzles, (d) hands.

In all public lavatories, the water-closet seats should be made with an intervening gap of a few inches in its most anterior section.

Douche nozzles should be personal, and this should be ensured by their being kept under lock and key. No laxity in the sterilization of gynæcological instruments should be tolerated. Actions for substantial damages have been successfully raised in America against physicians for carelessness in this respect, and the fact that none have been reported in this country so far is not for want of cases. Usually attention is first drawn to such a case by the infection of the husband.

### CO-EXISTENCE OF OTHER ORGANISMS WITH THE GONOCOCCUS IN THE FEMALE GENITO-URINARY TRACT

In speaking of the bacteriology of gonorrhœa in the female, reference was made to the numbers of other germs seen in smears, and a description of the commonest of these has already been given. The relative importance of these contaminating organisms

in the production of inflammatory processes is a question of much practical interest.

Menge very ably supports the view that they are for the most part saprophytes living in the exudation and not in the tissues. He denies that the gonococcus will tolerate the growth of any other organism alongside its own colonies, and affirms that the toxin of the gonococcus, if in sufficient concentration, destroys other bacteria, and that there is always, therefore, an appreciable distance between the fields of gonococci and those of any other coexisting organisms. Menge speaks of a "fighting zone" above which, in gonorrhœal disease, the gonococcus exists in pure culture. He places this in the case of the urinary tract just within the meatus of the urethra, and in the case of the genital tract of adults just within the cervix. Contamination of smears and of cultures is with difficulty avoided, owing to the presence of numerous pyogenic and other organisms at the entrance both of the urethra and cervix, but if stringent measures are taken to avoid the possibility of admixture with these extraneous organisms, gonococci alone, according to Menge, will in almost all cases be demonstrated.

The expressions "mixed infection" and "secondary infection" have certainly been somewhat loosely employed; and as Menge has elaborated a very complete classification, which includes all the methods in which other germs can complicate gonorrhœal inflammation, I have accepted it with acknowledgment of Menge's success in so far maintaining the truth of his views, although unable to follow him to his ultimate conclusions.

Classifications of bacterial infections in the female (Menge):—

*An infection* is a disease of the organism produced

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and maintained by the penetration of parasitic micro-organisms into the living tissue.

*Simple infection* is one in which only a single species of micro-organism is present in the tissues.

In *mixed infections*, on the other hand, two or more varieties of parasites are involved in producing disease in the same tissue regions.

It is not permissible to distinguish as an infection a condition in which there is saprophytic growth of organisms in an excretion or secretion without an actual invasion of the tissues.<sup>1</sup>

*Several simple infections* may coexist at one time in the same individual, entirely independent of and separated distinctly from one another. Such a condition would arise if, in a case of puerperal endometritis due to pyogenic streptococci, there existed at the same time a gonorrhoeal infection of the urethra.

The expression "*Primary Mixed Infection*" denotes the coincident invasion of the same area by two or more varieties of parasitic micro-organisms, whereas, in "*Secondary Mixed Infections*" following the settling of one form of micro-organism in living tissue and during its continued activity there, another organism makes effective entrance into the same region. During the course of either a primary or a

<sup>1</sup> An objection to this contention is that although it may be impossible to demonstrate the presence of the so-called saprophytes in a tissue section, their activity on the surface of the mucous membrane or in ducts, glands, or lacunæ, without penetration of the cells or intercellular spaces, may give rise to an inflammatory reaction, owing to the irritation produced by their toxins or otherwise. Again, organisms which at one step of an inflammatory process may be, as defined by Menge, purely saprophytic living in an excretion or secretion, may at any moment of a later stage become infective owing perhaps to the destruction of superficial protecting epithelium.

It has also to be noted that such saprophytes escaping from the Fallopian tubes into the peritoneum might be responsible for a peritonitis. In the same way, a cystic abscess might be caused by the inclusion of facultative saprophytes in the cavity of a gland, when the duct became obstructed by inflammatory adhesion.

secondary mixed infection the disappearance from the scene of action of one of the infecting agents may end in the establishment of a simple infection, and this is called "*a Simple Secondary Infection.*"

The position which Menge takes up in relation to the finding of various conflicting organisms in a smear preparation, is that they do not necessarily indicate a mixed infection. On the contrary, a true mixed infection in gonorrhœa rarely, if ever, can arise. To obtain a smear from the site proper to the growth of the gonococci which are present is only a question of technique, and if a specimen can be got directly from the gonococcal area uncontaminated by contact with the lower passages it will be found to contain gonococci in pure culture. For instance, in gonococcal endometritis a specimen obtained by approaching the endometrium through the uterine wall in the course of an abdominal operation or a post-mortem examination will show only gonococci, an entirely different picture from what would be seen in a smear taken via the cervix in the same case.

While the streptococcus, staphylococcus, and the bacillus coli frequently vegetate as saprophytes in the exudation of a mucous membrane infected with gonorrhœal inflammation, the gonococcus never does so. It thrives only in and upon the tissue, and any gonococci found in the exudation have been separated from the mother colonies in the tissues as they cannot survive as facultative saprophytes in a secretion. On the other hand, the common pyogenic organisms and the bacillus coli may, and frequently do, exist in secretions and inflammatory exudations merely as facultative saprophytes, and their presence there in no way indicates their presence in the tissues furnishing the exudation.

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The gonococcus is an extremely delicate organism and very sensitive to changes in its environment. When the products of their own metabolism or the metabolism of other germs is not removed by drainage, e.g., in a closed tubo-ovarian abscess, gonococci soon perish.

## CHAPTER XV

### THE TREATMENT OF GONOCOCCAL INFECTION IN WOMEN

THE principles which govern the treatment of gonococcal infection in the male apply with equal force to the disease in the female, but the differing anatomical and physiological conditions necessitate a considerable modification of the methods employed.

Having obtained by inspection and bacteriological examination a complete knowledge of all the sites where the gonococcus has secured lodgment, these areas which are within reach are directly attacked. The antiseptics chosen should have at the same time the greatest penetrating and the least irritating action on the tissues as well as the highest specific bactericidal effect on the gonococcus. The mode of application must introduce no risk of any further extension of the infection, and reinoculation must be guarded against by the observance of the strictest cleanliness.

*General treatment.*—The constituents of the urine have less influence on the disease in women, either for good or evil, than is the case in men. Urethritis is seldom productive of much discomfort, painful urination not being a marked feature and cystitis when it does occur usually being limited, in an un-mixed gonococcal infection, to a collection of discrete patches on the trigone. The balsams and urinary antiseptics therefore play a less prominent

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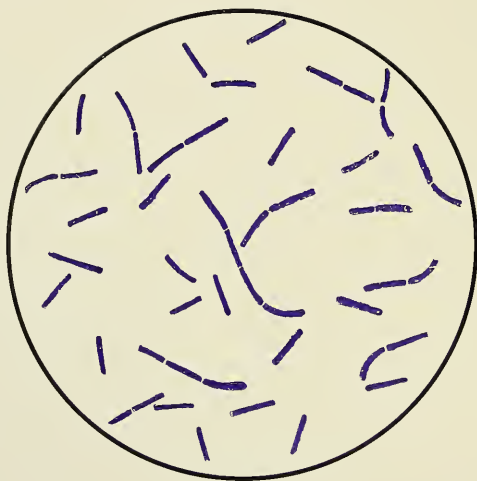
rôle in the female than in the male. When, however, symptoms of dysuria or pyuria arise, sandalwood oil in capsules and hexamethylenamin or boric acid with atropine or hyoscyamus and *uvæ ursi* are indicated. In all acute conditions rest in bed is advisable for a few days, and in hyperacute cases with excoriation and œdema it is essential. The same regulations as to diet, exercise, and general hygiene as are applicable in the male should be observed by female patients.

Too much prominence cannot be given to the necessity for maintaining the most scrupulous cleanliness. A sanitary towel should constantly be worn to protect the clothing from contamination. Sitz baths containing a liberal but unirritating proportion of some antiseptic such as kerol or Jeyes' fluid should be employed several times daily during the acute stage.

*Treatment of the external genital surfaces.*—On separating the labia the mucous surfaces should be carefully inspected for areas of reddening. Para-urethral passages and vulvar crypts, both of which are exceedingly common, should be sought for and examined bacteriologically if there is any indication of redness or purulent exudation. The ducts of the Bartholin glands receive similar attention. On locating the gonococcus in any of these localities, systematic treatment of each spot must be begun and persevered with until the gonococcus is exterminated. Protargol (1–2 per cent) or a corresponding concentration of any other silver preparation is applied on fine cotton-wrapped probes or injected through a blunted hypodermic needle as may be found necessary. This should be repeated daily, varying the strength of the application and the agent employed



PLATE XI.



Lactic Acid Bacillus.

according to the effect produced. Too much reaction from over-treatment must be avoided.

Infected para-urethral passages, crypts, and gland ducts which do not respond to this treatment may be subjected to electrolysis after cocainization. Abscesses arising from Bartholin's glands are incised and packed with gauze damped with a mild silver solution.

*Treatment of the urethra.*—The urethra when infected receives injection treatment by means of an all-glass syringe with acorn nozzle and a capacity of one dram. Protargol ( $\frac{1}{2}$ –2 per cent), colossal argentum, iodargol, etc., may be used for this purpose. The urethra should be filled several times at each sitting and the solution retained for two or three minutes each time.

*Treatment of the cervix.*—After thoroughly swabbing the vagina with biniodide (1–2000), lactic acid (1–100), or other antiseptic with the aid of a Sim's speculum and a retractor, the cervix is displayed, the external os carefully cleaned, and the cervical canal treated with protargol 2 per cent or whatever other preparation is preferred. This is best carried out by means of long, fine wool-bearing probes saturated with the solution. These are inserted with a gentle rotatory movement, and several probes are employed, each succeeding probe being carried a little further than the previous one. The greatest care must be exercised not to dilate the internal os and enter the uterus unless endometritis is indicated by a patent internal os and a copious flow of muco-purulent discharge. Sometimes it is necessary to dilate or incise the external os to allow of easy access to the cervical canal, and to secure satisfactory drainage, especially when, as occasionally happens,

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the canal has been converted into a sacculated cavity.

*Treatment of the vagina.*—Although the vaginal walls of the adult female are only exceptionally the seat of gonococcal inflammation, the toxins of the cervical discharge irritate the vaginal mucosa. In the resulting sero-purulent exudation myriads of saprophytic organisms thrive and, the conditions being unfavourable to its growth, the bacillus of Doderlein retires into obscurity or entirely disappears. Regular cleansing of the vagina therefore becomes a necessity. For this purpose swabbing is more efficient than douching, and the antiseptic indicated is the B.P. lactic acid in a concentration of 1–100 to 1–200. When douching has to be relied on the strength should be 1–300. The swabbing should be done gently but thoroughly each day, and after the vagina has been carefully dried with aseptic wool a liquid culture of an innocuous lactic acid bacillus, such as the bacillus *Bulgaricus*, recently incorporated with lactose powder, should be inserted into the vagina to take the place of the defunct Doderlein bacillus. Some strains of lactic acid bacilli will not survive many days in the dry state, and it is therefore advisable to make the preparation freshly or at least once a week.

*Summary of the local treatment in the female.*—The treatment of gonorrhœa in women may be summarised by describing shortly the method which has been evolved at the Glasgow Lock Hospital.

After a prolonged sitz bath, containing about an ounce of kerol, the vagina is carefully and gently swabbed with 1–2000 biniodide of mercury solution, or 1–100 lactic acid. Various other antiseptics may be used, e.g., perchloride or oxycyanide of mercury,

## GONOCOCCAL INFECTION IN WOMEN 265

iodine, formalin, etc. Care must be taken to remove all trace of the mercurial antiseptic, and the next procedure is, therefore, to swab well with plain sterile water, and then dry with wool. Colossal argenticum or protargol, 1-2 per cent, is then thoroughly applied to each infected area, the urethra, cervix, and every reddened patch or pocket receiving careful treatment with wool-wrapped probes dipped in the solution, or by means of injections through blunted hypodermic needles where probes cannot enter. The parts are again dried, the cervix when patent lightly packed with lactic bacillus powder, a bacillus pessary inserted high up in the vagina, and the patient returned to bed.

This routine is carried out night and morning for three or four days, when the condition will be found to have greatly improved as regards the quantity of discharge and the presence of saprophytic organisms. We then rely on lactic acid 1-100 to 1-200 as the only antiseptic for swabbing, and the powder and pessaries as before. The silver preparation is continued for the urethra and all vulvar recesses harbouring gonococci, but the cervix and vagina, as a rule, only receive lactic acid swabbing and the powder and pessary, whose composition I must now explain. I started in 1909 to use lactic acid bacilli for the treatment of gonorrhœa in women. Several methods of applying this agent have since been tried, and the outcome of our experiments is a mixture of a liquid culture of lactic acid bacilli and sugar of milk, allowed to dry under aseptic conditions. While the mixture is damp and mouldable, short rods are punched out of the doughy mass, and after drying are used as pessaries. The remnants are allowed to dry, and are then crushed into powder form. The

preparation has to be made weekly, as the bacilli lose their activity if kept long in the dry state.

There are doubtless plenty of innocuous lactic acid producing organisms which could equally well serve our purpose, and whose vitality would not suffer from being made into tablet form, but we get such good results from our present method that I am loath to change since we have in the laboratory facilities for making the product.

But for use in general practice it is highly desirable that a preparation which will keep active for a reasonable period should be put on the market, and I hope that this will soon be accomplished. Meantime the admixture of one of the fluid cultures with sugar of milk, under strict aseptic precautions, will furnish a paste which will serve the purpose excellently.

The rationale of this treatment I can only tentatively explain, but the clinical effects are highly satisfactory, and I know of no other method of arriving at anything like the same results. To attempt to eradicate the gonococcus from the cervix and uterus by applications of gonococcal antiseptics, however energetic, is wellnigh hopeless. Our use of a preliminary antiseptic treatment shows what benefit can be got in this way ; but when a certain stage has been reached no further progress seems to be attainable, and only by continuing indefinitely the antiseptic measures can this improvement be maintained. The point where one can say that absolute cure has been effected, the gonococcus being permanently absent from the smears, has been very difficult to realise in women. The addition, however, of the lactic acid bacillus to our therapy alters the whole picture.

## GONOCOCCAL INFECTION IN WOMEN 267

Now, by what hypothesis can our results be explained? We use two agents not generally used by others. One, sugar of milk, is known to have an inhibiting action on microbic growth, and doubtless some proportion of the credit must be awarded to the saccharine material. But sugar alone, while helpful, fails in practice to give the full benefit derived from the combination. The other, the lactic acid bacillus, is the more active partner, but it requires the sugar as a medium for growth and for the production of one at least of the agencies by which it effects its beneficial powers, viz., the lactic acid. The gonococci embedded in the epithelial and sub-epithelial tissues are beyond the reach of its action, but the growth of superficial colonies from which the deeply lying organisms are recruited is prevented. The continuous antiseptic action of the nascent lactic acid destroys the surface organisms in glands and crevices more effectively than any temporary application of an ordinary antiseptic can be expected to accomplish. But we may accept that there is in addition a healing effect on the protective epithelium, in part directly due to the astringent action of the acid, and in greater part due to the absence of the destructive toxins of the pyæmic organisms.

There is certainly a great reduction in the quantity of secretion poured out by the mucous surfaces, and it may reasonably be inferred that the toxins of the deeply situated gonococci which usually escape in this secretion are diverted into the normal channels of absorption, and thus reach the general circulation, where they may be counted on to stimulate the formation of antibodies in quantity sufficient to cope with the gonococci embedded in the tissues, and, therefore, within reach of their action. In this way

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a natural vaccine therapy is excited and the gonococcus ultimately exterminated.

Several modes of treating vaginal discharge have been tried, but in my experience none can compare in effectiveness with that outlined above. Packing the vagina with gauze impregnated with various medicaments, dusting or filling it with absorbent powders, distending it with dilute chlorine gas and repeated and prolonged douching have now been discarded in my practice in favour of the lactic acid treatment.

*The treatment of chronic infections in the female.*—There is little to add to what has already been said. In cases which fail to respond within three or four weeks to the above treatment, careful examination will show the presence of a subacute or chronic tubal abscess draining into the uterus or an infected tubule or crypt, which has escaped observation. When the urethra is the seat of a chronic infection, Skene's ducts should be inspected, and, if necessary, treated through the urethroscope, and the bladder may be examined cystoscopically. The Bier method may be applied to the cervix in subacute and chronic cases by means of the special glass tube made for the purpose. It certainly assists in emptying the numerous cervical glands of their contents, and it may ultimately prove of service in combination with vaccine or serum. Before adjusting the tube, the cervix should be well cleansed and a generous supply of the silver solution left in the canal. The silver solution should be reapplied after removal of the extracted secretion. This method, a hospital matron tells me, is not suitable for indiscriminate use.

It seems hardly necessary to state that, throughout the existence of a gonococcal infection of whatever

## GONOCOCCAL INFECTION IN WOMEN 269

nature, coitus must be refrained from. Not only is there the risk of infection being conveyed to another, but also of an exacerbation being excited in the patient. There is nothing so likely to produce salpingitis and other complications as coitus. In my experience salpingitis is much more frequent in married women and in habitual prostitutes than in cases where connection is not repeated after infection. Another relative point in the case of married women is to ascertain before sanctioning cohabitation that the husband is not a carrier of disease.

### ASSURANCE OF CURE IN FEMALE PATIENTS

How can we convince ourselves that a patient is cured and free from risk of recurrence? In the first place there is the absence of all abnormal appearances of the genital tract: no purulent discharge or areas of redness are seen on separating the labia or on displaying the cervix; also no gonococci can be found on prolonged and repeated search either in urethral or cervical smears.

In case of doubt it is possible to excite any latent gonococci into renewed activity, so that they can be found in smears, by slightly irritating applications, such as 1-1000 nitrate of silver solution, or by a hypodermic injection of a small dose (five to ten million) of vaccine. If they are present they should be found and destroyed. It is not wise in this case to "let sleeping dogs lie." The intradermic vaccine reaction and the complement-fixation test, if distinctly negative, are of diagnostic value, but it is not yet definitely ascertained how long positive reactions may survive in the absence of the gonococcus. These reactions merely indicate the presence of antibodies

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in the blood, and it is probable that these antibodies continue to exist for short periods, varying in different individuals, after the final extinction of the organisms. The skin test is easily applied. These tests are described in the chapter on immunity reactions.

## CHAPTER XVI

### COMPLICATIONS OF GONOCOCCAL INFECTION IN THE FEMALE

ALL the various conditions by which entrance of the gonococcus into the blood-stream can evidence itself may occur at any time throughout the existence of the disease. So long as a local focus of gonococcal infection persists, there is the risk of rheumatic affections of the joints and tendon sheaths, endocarditis and pericarditis, phlebitis, pleurisy, iritis, conjunctivitis, or even grave septicæmia.

The most important element in the cure of these conditions is cutting off the supply of the invading organisms by destroying the foci of infection in the genital tract. Vaccine therapy is also of value, but there are several points regarding the action of gonococcus vaccine which require elucidation before it can take an assured place in treatment.

*Bartholin abscess*, or rather, pseudo-abscess, it being really a suppurating retention cyst, is of frequent occurrence. A small incision to allow of drainage is sufficient, and the cavity is regularly injected with silver solution and packed with gauze until germ-free.

*Para-urethral passages and vulvar pockets*, so frequently present in women, must be carefully looked for and treated with silver solution if found infected, otherwise they will prove a source of reinfection.

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When the urethra, in spite of treatment, still gives a positive smear, it is necessary to use the urethroscope or a speculum (Fig. 65) to locate and treat any duct or crevice which may not be receiving sufficient of the ordinary application. Skene's ducts, which open into the urethra, may be the cause of a continued infection.

*Gonococcal cystitis* is suggested by the presence of a quantity of pus in the urine. A small amount of pus may originate in the urethra, or vulvar or vaginal pus may accidentally be mixed with the urine. To ascertain the condition of the bladder accurately

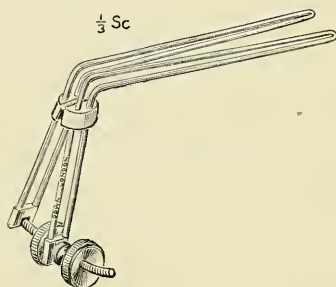


FIG. 65.

Parnell's speculum for the female urethra.

it is necessary for the nurse to cleanse the whole vagina and request the patient to pass urine in two portions. The first specimen contains, in addition to the contents of the bladder, all pus washed out from the urethra, while the second shows the condition of the bladder.

It is not wise to cystoscope a bladder in acute conditions, but all that would be seen in gonococcal cystitis is a varying number of small reddened areas with injected margins scattered over the trigone. The treatment consists in washing out the bladder with a weak solution of permanganate of potash

1-8000 to 1-4000, or one of the organic silver preparations, e.g., albargin 1-5000 to 1-2000. A urinary antiseptic is also advisable, and in prescribing such it is necessary to know the reaction of the urine. If it is frankly acid or can be rendered acid by administering the acid phosphate of soda in 30-grain doses three times daily, urotropine is indicated, otherwise boric acid is to be preferred. *Uvæ ursi*, which is antiseptic and diuretic, is a suitable vehicle. Sandalwood oil is also of service both as an antiseptic and sedative. It is prescribed in 10-minim capsules three or four times a day after meals.

*Extension to the kidneys* is a grave, but fortunately uncommon, complication. The treatment is ureteral silver injections (see p. 306).

*Condylomata acuminata* (venereal warts) are fully described in a later chapter.

#### GONOCOCCAL INFECTION OF THE UTERINE MUCOSA

It is usually taught that gonococcal infection is in the great majority of cases limited to the cervix, and that only occasionally does the inflammatory process extend beyond the internal os, and that when extension upward does occur the tubes are usually implicated. The general impression has been that the uterine mucosa did not form a very suitable nidus for the propagation of the gonococcus, but that it was capable of passing on the infection to the Fallopian tubes, when a typical salpingitis would develop with perhaps an accompanying pelvic peritonitis. Bumm has had most influence in spreading this belief, but his teaching is insufficiently supported either by clinical observations or by bacteriological

investigations. He asserted that gonorrhœal endometritis was ushered in by severe feverish symptoms, and that it was of rare occurrence. There is, however, no reason to be found in the histological structure of the endometrium why gonococci should not flourish thereon, and no permanently closed sphincter to separate the cervix from the cavity of the uterus. Moreover, Wertheim has demonstrated gonococci in curetted portions of the endometrium from both acute and chronic cases. He states that no special symptoms accompanied the involvement of the uterine mucosa in the acute cases by which an endometritis as distinct from an endocervicitis could be diagnosed. However, Bumm's assertion that an increase in temperature accompanies acute gonorrhœal endometritis is true in some cases. It is frequently impossible to decide by any justifiable method of diagnosis whether the uterine cavity has been involved, but I am convinced that it is much more frequent than has been generally believed. If the internal os is open, the uterus palpably enlarged, and the quantity of exuding muco-purulent secretion considerable, it may be accepted that the uterine mucosa is actively attacked.

As factors favourable to the spread of the infection to the endometrium may be mentioned menstruation, the puerperium, coitus, and instrumental interference. The same influences may determine an attack of salpingitis from the passage of the gonococcus into the Fallopian tubes; but as it is true that the internal os acts as a barrier in some cases to the extension of the gonorrhœal infection, so also should the more minute uterine orifices of the Fallopian tubes in a still greater proportion check the further spread of the disease.

## GONOCOCCAL ENDOMETRITIS

About half of all cases of endometritis are gonococcal in origin. Gonococcal endometritis may be acute or subacute, and both of these forms may merge into a chronic endometritis. The onset of endometritis is usually insidious, and the subacute type prevails, but occasionally a more acute invasion is met with.

*Symptoms of acute endometritis.*—The temperature is raised, but seldom exceeds  $101.5^{\circ}\text{F.}$ ; the pulse ranges from 100 to 120 and the general symptoms of fever are present. Pain is complained of in the suprapubic region, and there may be slight symptoms of bladder and rectal irritation.

Bimanual examination, which must be conducted with gentleness, will discover the uterus slightly enlarged, and pain will be elicited by manipulation. There is always some degree of metritis present. On inspection of the cervix a day or two after the onset a profuse glairy discharge (muco-purulent at a later stage) will be seen exuding from the patulous os of an enlarged reddened cervix, unless the internal os is closed, in which case the excessive discharge will appear intermittently.

The gonococcal nature of the infection is proved by finding the organism in smears and cultures from the cervical discharge. It is not practicable to obtain an intrauterine swab on account of the risk of causing spread of the infection to the tubes.

*Treatment.*—Rest in bed, regulation of the bowels, suitable diet, hot suprapubic applications, hot sitz baths, large hot vaginal douches of 1–300 to 1–500 lactic acid, followed by the insertion of the lactic acid bacillus pessaries, will result in subsidence of the

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symptoms within a few days unless the tubes are involved. I believe that quinine is of some value in these cases. Atropine should be used as a sedative and to obviate peristalsis of infective material into the tubes.

*Subacute endometritis* is much more common, but is more difficult to diagnose unless as an accompaniment of salpingitis. It can be inferred when the cervical discharge is excessive, when the uterus is enlarged and the internal os readily entered while probing the cervix. The patency of the internal os is perhaps the most suggestive symptom. This will not be discovered while irritating solutions, which stimulate contraction, are being used to the cervix.

It requires no special treatment other than that already outlined. Local applications to the endometrium should be withheld.

*Chronic gonococcal endometritis* is of significance principally on account of the constant danger of the onset of salpingitis and also as a cause of sterility and of continued infectivity.

The symptoms are the same as in subacute endometritis, with the addition that the menstrual functions may be interfered with. Thus there may be irregularity, menorrhagia, or dysmenorrhœa. The dysmenorrhœa is of the congestive type, the pain persisting during the first two or three days of the flow.

*Treatment.*—Before undertaking any local treatment it is necessary to ascertain with as great accuracy as is possible that neither of the tubes have been infected. If a quiescent salpingitis exists an exacerbation may be determined by any intrauterine instrumentation. The usual treatment recommended is dilatation and curettage followed by the applica-

tion of tincture of iodine or other strong antiseptic solution.

But it is impossible to remove or destroy the entire endometrium and its infected glands; and if this could be done obliteration of the uterine cavity would result. It is therefore entirely a matter of chance and seldom realised that the infection is completely exterminated. The result frequently is that no benefit is derived, and, in the event of no harm ensuing, the patient has at least run an unnecessary risk. I do not dispute that in a carefully selected case, curetting may be advantageous and hasten recovery, but I am strongly of opinion that in the majority of cases in which it is undertaken it is useless, and in not a few harmful.

When curetting is decided upon, it should be performed immediately following menstruation when the mucosa will be thin, and it should be followed by careful drying of the uterus and a thorough swabbing with tincture of iodine.

Short of curetting, the local treatment of the endometrium usually adopted consists of injections or swab applications of tincture of iodine, formalin, strong silver nitrate (1 dram to the ounce), carbolic acid, etc. These are all equally disappointing. Since having given up curetting and caustic applications, my results have been much more satisfactory, and cure has been more quickly attained.

It is, in fact, a hopeless task to attempt to abort gonorrhœa in the female. Cases at a stage of infection sufficiently early to make this procedure feasible rarely come under observation, and although the cervical and uterine tissues may be subjected to a much more energetic treatment than is possible in the male urethra, no line of radical treatment short

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of hysterectomy promises much hope of success. The gonococcus quickly penetrates the glands and the tissues to a depth beyond reach of the curette and antiseptic, and it lies dormant in these safe retreats until the mucosa is reconverted into a medium suitable for its growth, when it springs into renewed activity.

It is of the utmost importance in treating the endometrium to adopt some precaution which will obviate the risk of forcing infected material into the

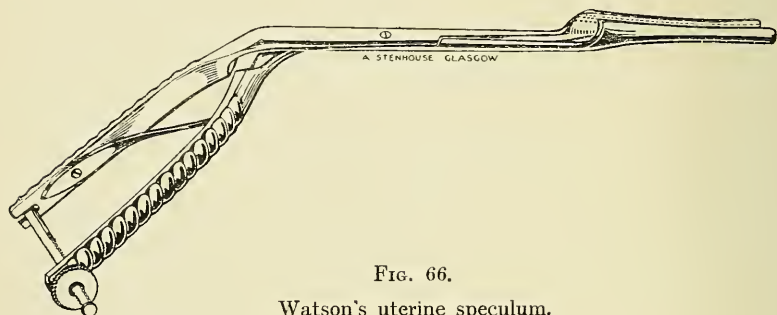


FIG. 66.

Watson's uterine speculum.

tubes. With this object in view, I employ a uterine speculum (Fig. 66), through which the solution can be injected or applied, and, instead of the ordinary probes, use metal tubes with rounded and open ends and suitable curve, to which the wool is attached (Fig. 67). Another method is to insert a double-channel canula, through one division of which the solution may be injected. In none of these procedures is the intrauterine pressure increased, as may so readily happen in the passage of the ordinary wool-wrapped probe. With the os closed as it is by the Playfair probe, any rise in the intrauterine pressure tends to adjust itself by the escape of the uterine contents into the Fallopian tubes.

Treatment of the cervix or endometrium by caustic

applications in most cases delays cure, and is seldom of any benefit. If there are any definite lesions which should obviously be destroyed, such as Nabothian cysts, granulations, papillomata, or polypi, they should be treated by incision, curetting, or electrolysis, preceded and followed by unirritating antiseptic solutions. The indiscriminate use of strong caustic solutions is one of the mistakes of gynæcological practice, and the same remark applies to many, if not most, of the curettage operations which are undertaken.

The only intrauterine treatment I now employ is applied through the uterine speculum or by means of

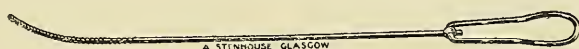


FIG. 67.

Uterine applicator.

the tubular sound, and unirritating solutions are used, such as iodargol, colossal argentum, or 5 per cent protargol or the powdered lactic acid bacillus preparation. But it is seldom that treatment carried out on the lines indicated for cervical gonorrhœa is not found sufficient. Unless the tubes are involved, perseverance will be rewarded by the disappearance of gonococci in from three to six weeks even when endometritis is present.

#### GONOCOCCAL INFECTION OF THE FALLOPIAN TUBES, OVARIES, AND PERITONEUM

For a full discussion on pelvic inflammatory conditions recourse must be had to books on gynæcology, but there are some points of view which

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perhaps are not sufficiently appreciated by gynæcologists and which may be presented here.

Extension to the Fallopian tube is most prone to occur following menstruation, sexual connection, abortion, or parturition. The gonococcus may reach the tube by means of mucous currents, peristaltic action, instrumentation, or by direct extension from an endometritis. It immediately produces its characteristic inflammation with purulent exudation. The pus may escape from either end of the tube. In the uterus the discharge excites an endometritis if this is not already existent. In the pelvis a plastic peritonitis is produced with rapid formation of adhesions closing the internal ostium and preventing further leakage in this direction. The uterine end of the tube soon also becomes occluded and the tube converted into a pus sac. When this has been achieved the symptoms usually decline in severity, the contents of the tube ultimately become sterile (two to three months), and gradual absorption takes place with continued improvement in the patient's health. This cycle of events being the rule in gonococcal salpingitis, palliative treatment in contradistinction to operative treatment is obviously indicated.

*Symptoms.*—The symptom which usually first attracts attention to the onset of salpingitis is pain. It is most marked in the corresponding inguinal region and tenderness is also obtainable in the same area. The pain may radiate across the abdomen and back, and down the thigh. There is usually constipation, on account of the pain attending the act of defecation. The temperature rises to round 103° F., the pulse attains 120, and the general signs of fever are present. The menstrual functions are usually disturbed.

A bimanual examination is necessary to settle the



FIG. 68.

ACUTE GONORRHEAL SALPINGITIS.

This specimen was removed during the early stage of the disease. The tube is somewhat uniformly enlarged, much bent upon itself, and presents numerous adhesions. The abdominal ostium is patulous. The fimbriæ are greatly swollen and everted. On milking the tube, pus could be expressed through both ends.—[Norris.]



FIG. 69.

#### GONORRHEAL SALPINGITIS.

The section has been taken through the ampulla of the tube. The muscularis is thin, and contains numerous areas of inflammatory infiltration. The mucous folds are gracile, and their epithelium is somewhat flattened and degenerated. But few pseudo-glands are present. On macroscopic examination a little pus could be seen in the tube. The abdominal ostium was open, although somewhat contracted ( $\times 16$ ). [Norris].

diagnosis, but it must be conducted with the greatest gentleness. Careless handling is very likely to separate restricting adhesions, and to cause leakage of pus into the peritoneal cavity.

One tube only is affected, in the first instance at least. The other may become involved later. There will probably be some increased resistance felt in the pouch of Douglas, and fear will compel the patient to contract the abdominal muscles. But an expert examiner will, without the exercise of any force, in almost any case be able to outline the affected tube. According to the stage and the acuteness of the disease, the inflamed mass will vary from the size of a finger to that of an orange. It may sink into the pouch of Douglas behind the uterus or it may be fixed by adhesions higher in the pelvis; the latter position is more frequent. The ovary is usually more or less involved in the inflammatory process, and there are also localised areas of pelvic peritonitis with resulting adhesions.

*Treatment.*—The essential element in the treatment is to ensure rest of the parts to allow of rapid limitation of the area involved by the growth of adhesions. Rest in bed in the upright (Fowler) position, if it can be maintained with comfort, tends to promote uterine drainage and to assist in localising the inflammation in the pelvis. Hot applications to the abdomen are soothing, and in the later stages promote absorption. No treatment involving intrapelvic manipulation is justifiable in the most acute stage. Later, copious hot douches of weak lactic acid and in addition tampons saturated with 10 per cent ichthyol and 2 per cent lactic acid inserted on two days each week, and the lactic acid bacillus pessaries on the other days, are beneficial.

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The use of electrically heated vaginal tubes has been warmly advocated as tending to promote absorption and also inhibition of gonococcal growth.

Surgical interference is rarely justified in purely gonococcal disease in the pelvis. The rôle of surgery is limited to the late separation of adhesions, and plastic operations to restore the parts to a condition in which they may be enabled to perform their physiological functions. The intrusion of a virulent streptococcus or other pyogenic organism into a field weakened by the previous activity of the gonococcus may, of course, necessitate active surgical intervention.

### GONOCOCCAL INFECTION AND PREGNANCY

Gonococcal infection, while it decreases the probability of conception, does not negative the possibility. Whether a woman is rendered sterile or not depends on the areas involved and the amount of damage inflicted. Gonococcal infection may be coincident with conception, it may follow it, or precede it. Therefore all stages of gonorrhœa—acute, subacute, or chronic—are met with in pregnant women; but, as the pregnant state seems to furnish the gonococcus with the conditions which favour its growth, the symptoms are more marked, exacerbations more frequent, and complications more liable to supervene. It is calculated that from 5 to 10 per cent of pregnant women harbour the gonococcus, and that from 15 to 30 per cent of cases of puerperal fever are directly or indirectly due to the organism.

It need hardly be said that pregnancy increases the urgency of the case. Looking at the cervix of a

pregnant uterus bathed in offensive pus we see how auto-infection, not only from the gonococcus, but from the bacillus coli, the staphylococcus, the streptococcus, etc., all or any of which may be present in the secretion, may arise. These organisms, which are probably living as saprophytes in the exudation, can readily play a different rôle if they gain access to the placental site of a puerperal uterus. Exterminate the gonococcus with its irritating toxins, the inflammatory secretion is no longer produced, and in the absence of the medium on which the saprophytes thrive they can soon be dislodged from the vagina.

The plan of treatment differs in no way from that already described, but the whole process must be carried out with the utmost gentleness, and it can, therefore, only be entrusted to specially trained nurses, otherwise over-manipulation might induce premature labour.

*Complications.*—Pregnancy tends to increase the incidence and the acuteness of gonorrhœal rheumatism and the other metastatic complications.

*Condylomata acuminata.*—Large masses may appear within a few weeks. Pregnancy favours the formation of these growths. Sometimes they develop into large cauliflower excrescences. These usually consist of three or four main clumps with enormous numbers of small warts scattered over the vulvar skin and mucous membranes. They may be found on the vaginal wall and cervix, and are frequently found around the anus, suggesting rectal gonorrhœa. Their treatment is dealt with in a following chapter.

*Gonococcal infection of the placenta* has been demonstrated as a cause of miscarriage, and penetration of

the gonococcus into the amniotic fluid is a rare cause of prenatal destruction of the infant's eyes.

*The gonococcus in the puerperium.*—The onset of gonococcal endometritis after delivery is evidenced by fever, a muco-purulent element in the discharge, and inhibition of uterine resolution. It usually asserts itself about the fourth or fifth day, and runs a comparatively mild course unless complicated by the intrusion of other pyogenic organisms. Unless preventive measures have been adopted, a mixed infection may arise, or even more likely is the subjuration of the gonococcus, so far as the upper genital tract is concerned, by the most active of the organisms following the gonococcus in the cervix, commonly a streptococcus. Only microscopic and cultural examination can ensure a correct diagnosis, but the type of inflammation to which the gonococcus acting alone gives rise is, as a rule, mild, and controllable with purely expectant treatment.

## CHAPTER XVII

### GONOCOCCAL VULVO-VAGINITIS IN CHILDREN

VULVO-VAGINAL inflammation in children has long been known as being of frequent occurrence, but this condition has received little serious attention until recent years. Pott, of Halle, in reporting an epidemic in 1883, recognised the contagious character of the complaint, but not its association with the gonococcus as the causative organism. An outbreak in Posen during the month of August, 1890, was investigated by Skutsch, who found that 236 girls had contracted gonococcal infection in a public bath. Many instances in which the disease has spread through dormitories, wards, and institutions have since been recorded. Once infection gains admission to a children's institution, so much trouble is experienced in controlling and stamping out the epidemic that in many hospitals the rule is enforced that every female child is to be examined for vaginal pus and gonococci before admission to the general wards. Where search has been made at children's clinics for cases of gonococcal vulvo-vaginitis, it has been found to be present in from 2 to 12 per cent of the female children, the general average being about 4 per cent of all applicants for medical or surgical treatment.

*Etiology.*—Every case of vulvo-vaginal inflammation is not due to the gonococcus. Thus, the pneumococcus has been proved in occasional cases to be the causative agent, but the condition is then not

nearly so intractable. The irritation of thread-worms in the rectum may, in ill-nourished children, give rise to inflammatory conditions in which various organisms thrive. Diphtheria may attack the vulvar mucous membrane, when it is usually in association with diphtheria of the fauces or nasal cavity. But these are exceptional cases. The vast majority of cases of vulvo-vaginitis is due to the gonococcus.

In epidemic form the disease is spread by bath water, chambers, closet seats, towels, bed linen, rectal thermometers, attendants' hands, etc. In individual cases infection is incurred from adult members of the family. The horrible superstition surviving amongst the ignorant and vicious that contact with an immature vulva will ensure cure of a urethritis is unfortunately still responsible for a quota of innocent victims.

*Anatomy and physiology.*—In young children the course of the disease is influenced by the absence of the vaginal flora, the tender and non-resistant epithelial surfaces, and the absence of menstruation. The bacillus of Doderlein does not make its appearance in the vagina until the approach of puberty, and the epithelium of the vulva and vagina prior to its advent are both very susceptible to gonococcal inflammation, in this respect differing from the adult mucous membrane. The normal mucous membrane of the vulva and vagina is pink and slightly moist. On each side of and below the urethra a variable number of gland openings, in addition to the ducts of the Bartholin glands, are seen, and small recesses or para-urethral passages are not uncommon. The vagina is from  $1\frac{1}{2}$  to  $2\frac{1}{4}$  inches in length. The cervix is nipple-shaped and fairly constant in size, contributing about half the bulk of the uterus. The external os is

a minute circular or transverse opening too small to admit an ordinary probe.

A long-continued vulvo-vaginitis tends to hasten the development of the organs of sex owing to the increased blood supply of the parts.

*Symptoms.*—The inflammation produced by the activity of the gonococcus is an acute process. It spreads with great rapidity from the vulva to the vagina and cervix as well as to the urethra. On inspection, the whole exposed mucous surface is seen to be reddened and bathed in creamy pus. In the early stage, the parts are tender to touch, and the neighbouring skin may be excoriated by contact with the irritating discharge. In cases which are controlled by frequent cleansing, pus can be seen to well from the vagina on the patient making straining efforts, or it can be collected on a wool-wrapped probe.

As in the adult, the main sites of gonococcal seclusion are the vulval glands, including the glands of Bartholin, the urethra and Skene's ducts, and the cervix. But in children, the vaginal walls, although free from glandular structures, are affected by the inflammatory process, many small red areas where gonococcal invasion has occurred being seen on the vaginal walls when the coating of sero-pus has been removed. The hymen opposes no obstacle to the upward spread of the disease, and apart altogether from instrumental or other mechanical conveyance of the infection, the disease can, and does in most cases, reach the cervix, from which it is most difficult to dislodge. The only check to the onward progress of the inflammatory process is provided by the internal os, and that this barrier is not infrequently overcome is evidenced by the onset of salpingitis and peritonitis in some cases.

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*Diagnosis.*—In the most severe cases the whole vulvar mucosa is seen to be inflamed. In less acute cases and in chronic conditions the reddening is confined to the everted urethra, isolated areas of the mucous membrane, and gland ducts or recesses. Soon after cleansing, pus will be observed to reappear at the vaginal orifice if expulsive efforts are invoked. The presence of secretion and detritus, especially in the region of the clitoris, is not uncommon in neglected children, but in uninfected cases the stigmata of gonorrhœa are absent, and there is no deep vaginal or urethral pus. Although with experience the condition can often be diagnosed by inspection alone even in the temporary absence of pus, nevertheless both the diagnosis and the treatment must be controlled by bacteriological examination. At the first examination, several smears should be taken by means of sterile wool-wrapped probes or platinum spoons and in the following sequence: (1) From the vulva, after superficial cleansing with dry wool or plain water; (2) from the urethra, after thorough purification of the vulva; (3) from the vagina; (4) from the cervix, after as complete sterilization of the vagina as possible. To obtain the fourth specimen it is necessary to display the cervix, and this can usually be done without difficulty by means of a female urethroscope. An instrument provided with a reflected light, or an ordinary Kelly cystoscopic tube with a head mirror may be used, but the best illumination is obtained with an internally lit apparatus. It is an advantage to have the ends of the tubes cut obliquely as in the Ferguson speculum. A tube of suitable size is chosen, and with its obturator in position is passed as far as possible into the vagina and the obturator is withdrawn. By rotating the urethro-

scope and tilting it backwards, the cervix will be enticed into the tube, and with a very fine probe the secretion is secured for the smear. Before withdrawing the instrument the condition of the cervix and the nature of the discharge is noted. Search is made for erosions of the cervix and adhesions about the vault of the vagina. As the tube is withdrawn the vaginal walls are inspected for reddened and infiltrated areas or infected crevices. As a rule the gonococcus is present in each of the smears from an infected site in considerable numbers, and they are more readily recognised in these smears than in specimens obtained from the adult female on account of the paucity of contaminating organisms. The gonococcus is frequently obtained in pure culture from the upper part of the vagina and from the cervix.

*Complications.*—Gonococcal infection of the urogenital tract in young girls is liable to the same complications and sequelæ as in the adult female. Abscess of the glands of Bartholin is said to be uncommon, but according to my experience it occurs in much the same ratio as in adults. The Fallopian tubes are also liable to be involved, but the risk of this extension is somewhat less than in the adult on account of the absence of menstruation. When the peritoneal cavity is contaminated through the tubes, the resulting peritonitis tends to become localised in definite areas in the pelvis and a rapid recovery is the rule. A case is sometimes met with, however, where, owing to the weak resisting power of the patient or to hypervirulence of the particular strain of gonococcus, the inflammatory process spreads with great rapidity, and the general cavity of the peritoneum becomes involved before adhesions can be formed to limit the disease. Also, the rupture of an

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acute salpingitis may, by scattering foci of infection throughout the abdomen, give rise to an acute general peritonitis. But it should be remembered that the tendency in the great majority of cases of invasion of the peritoneum by a pure gonococcus infection is in the direction of localised areas of inflammation with the formation of protecting adhesions, and that operation is therefore not only not obligatory, but, during the active stage at least, is inadvisable.

Rheumatism of a mild type is not uncommon, and in occasional cases it may be acute. Ophthalmia may be due to infection by the blood stream in which case it is not severe, or an acute attack may be produced by manual transference of the organism to the conjunctiva. The risk of the latter must be anticipated and measures of prevention adopted.

*Prognosis.*—The outlook as regards rapid and permanent cure is not good. Relapses are to be expected, and bacteriological examinations must be made at regular intervals over a period of months. As long as the gonococcus remains in the genital tract the patient is liable to an attack of salpingitis with its sequelæ of adhesions and later interference with the menstrual function.

*Treatment.*—The treatment of gonococcal infection in young girls is attended with much more difficulty than in adult females and is too often disappointing. This is due not only to the difficulty of reaching the infected areas, but to the greater susceptibility of the epithelial surfaces and the less satisfactory drainage. Prophylaxis is therefore of the utmost importance both for the purpose of avoiding infection and preventing reinfection when cure has been attained. Isolation of each case from other children is the safest course, but this is seldom obtainable in practice.

It should be a notifiable disease, and under the control of the health authorities, who would supply hospital treatment for cases which could not be satisfactorily treated and isolated at home.

Whether treated in hospital or at home, the case should be in the hands of specially trained nurses under medical supervision. The hospital arrangements should permit of each patient having a separate cubicle partitioned off from the wards with sufficient glass in the walls to allow of constant observation. No toilet article should under any circumstances be shared with another.

The patient should not be bathed (unless a shower bath is obtainable), but daily sponging should be relied on to secure cleanliness, the genital region receiving prior attention with a different outfit and being carefully avoided during the general sponge. Gauze sponges should be employed, and destroyed after use. All toilet articles should be sterilized daily by heat. The common laundry is not a source of danger, and separate treatment of the linen is not necessary.

The children may be allowed up and out of doors, but always under the eye of the nurse. They should wear, in addition to a sanitary towel, closed knickerbockers so fashioned that they can only be undone by the nurse.

The nurse should approach the parts invariably with gloved hands, and she should steep the hands in antiseptic and dry carefully thereafter or wear fresh gloves for each case. A thermometer should never be inserted into the rectum. The use of water-closets should be entirely forbidden. The removal of the anterior portion of the seat or applying a fresh layer of paper as a protection does not remove

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the objection, as the splashing of a drop of water from the pan may mean reinfection.

The same principles of treatment apply in the case of children as in adults, viz., local cleansing and application of gonococcal antiseptics, and such general treatment as will raise the resisting power of the system.

The vulva can be cleansed by swabbing or by sitz baths, the vagina by swabbing or douching, and the infected areas must be soaked with an unirritating silver solution. When a douche is used the end piece or catheter should enter the vagina at least  $1\frac{1}{2}$  inches. Saline solution or an antiseptic solution may be used e.g., permanganate of potash (1 in 2000); boric acid (saturated solution); lactic acid (1 per cent). The solution should be as warm as the child can bear. But douching alone can never effect a cure; the important part of the treatment is the application of a silver preparation to the infected sites. Having ascertained to what extent the infection has spread (and in most cases each possible location will be found to be infected), attention has to be directed to each region. The smallest urethroscopic tube is inserted into the urethra just short of the bladder, when a wool-wrapped probe saturated with the chosen silver solution can be passed into the tube, the urethroscope withdrawn, and the probe left in situ for a few minutes. The cervix is displayed through a larger tube of the female urethroscope, and by means of a very slender probe a similar application is made to the cervix, care being taken that the internal os is not penetrated. The vagina is swabbed with the solution, and a layer of lint wet with the silver is left between the lips of the vulva for some time.

The choice of the silver preparation is important.

An efficient colloid such as "Colossal Argentum" gives good results and is quite unirritating. Protargol in glycerine is warmly recommended by Perrin, of Lausanne (protargol, 5·0; distilled water, 8·0; glycerine to 50·0 parts).

Pessaries of the lactic acid bacillus in lactose do not give the same satisfactory results as in the adult, but they are nevertheless of considerable value, especially in the older children. They can be crushed and inserted as powder through the urethroscope a few hours after the silver treatment.

Treatment should be continued daily until the gonococcus is permanently absent from the smears.

Vaccine therapy in vulvo-vaginitis has been the subject of some enthusiastic reports; but in my hands it has not so far proved of value; indeed, in some cases it seemed to determine a recurrence, and in others to invite complications.

## CHAPTER XVIII

### CONDYLOMATA ACUMINATA<sup>1</sup>

(VENEREAL WARTS)

WARTY growths are a not infrequent accompaniment of gonorrhœal infection, especially in patients who have an insufficient appreciation of the advantages of personal cleanliness. The vegetations may vary in size from a pin-point to a cauliflower mass. They adopt the physical characteristics of the tissue from which they spring, whether mucous membrane or skin ; but they all have essentially the same histological structure. The sites most favoured by these growths are, in the male, the inner surface of the prepuce, the coronal sulcus, the meatus urinarius, and the surface of the glans. A considerable growth within the sac of a tight prepuce may give rise to sloughing and sinus formation, or a strawberry mass may project from the preputial orifice. In women the areas most prone to be affected are the inner and outer surfaces of the labia, the base of the clitoris, the vaginal walls, the cervix, and also around the anal orifice. Pregnancy favours the formation of large masses, owing probably to the increased vascularity of the parts.

Condyломата acuminata occur more frequently in women than in men, and in the female they attain much greater dimensions. Large cauliflower masses

<sup>1</sup> This article first appeared in the "Lancet," 13th April, 1912.



PLATE XII.



Section of Condyloma Acuminatum stained with Hæmatein and Eosin.

may cover the vulva and perineum, while numbers of small warts occupy the adjacent skin and mucous surfaces. So long as they remain untreated they are kept moist by an offensive secretion containing the detritus of macerated epithelial and pus cells and numerous micro-organisms.

Histologically, they are composed of elongated branching papillæ, covered with an enormously thickened epithilium. The papillæ are supplied with



FIG. 70.

Vulvo-anal masses of condylomata acuminata.

capillary loops, surrounding which are frequent patches of small round-celled infiltration. Special nerve endings found in the epithelial layer are connected with a fine network of nerve fibres in the base of the papillæ. The main bulk of the hypertrophy is due to the rapid proliferation of the swollen cells of the Malpighian layer, which is therefore greatly increased in thickness. Between these epithelial cells numerous mononuclear and polynuclear wandering cells are found. The surface cells which form the thin horny layer tend to undergo maceration and desquamation, and minute areas of

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necrosis allow of serous and sometimes hæmorrhagic oozing.

The customary association of condylomata acuminata with gonorrhœa naturally suggests that the formation of these growths is induced by the irrita-

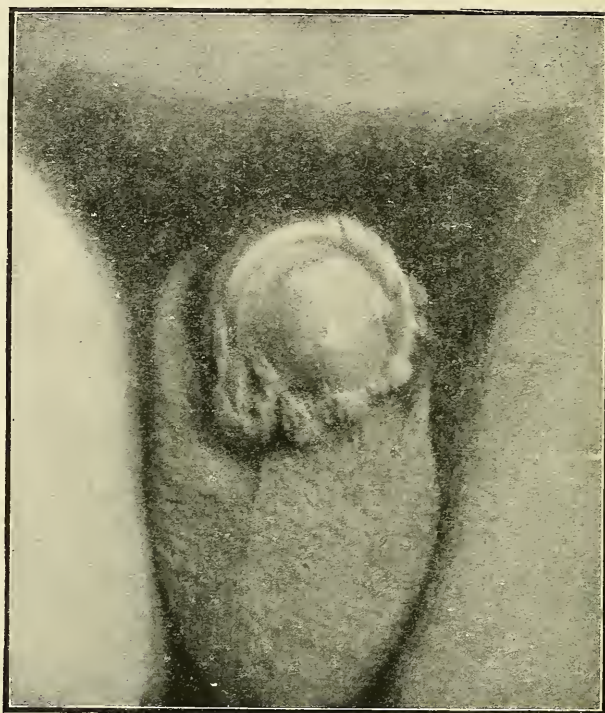


FIG. 71.

Condylomata acuminata of prepuce and glans.

tion of the gonorrhœal discharge. The gonococcus has not been demonstrated in sections; but other organisms such as streptococci, staphylococci, and more recently spirilla have, of course, been found. Whether these papillary hypertrophies are the product merely of a mechanical irritation or whether they owe their existence to the action of some specific

organism, acting on a suitably prepared soil, is a problem still awaiting solution.

*Treatment.*—The treatment which conspicuously suggests itself for all condylomata acuminata is excision with suture of the wound under local anæsthesia. Ligature of each portion separately or destruction by the use of caustics and cauteries are only mentioned to be dismissed as barbarous both in use and effect.

But even excision has disadvantages which prevent it from being of universal application. When large masses, such as are not infrequently found in females, have to be dealt with a general anæsthetic is required, and from one to two hours may be employed in removing several separate cauliflower excrescences as well as numbers of smaller growths. The time is mostly occupied in controlling hæmorrhage from the very numerous bleeding-points. When the most thorough removal possible has been effected and the remaining skin and mucous surfaces examined, these are found to be seeded with minute papillary vegetations, which one is tempted to treat with the thermocautery while the patient is still under the anæsthetic. The latter procedure is worse than useless, as it destroys only a fraction of the minute growths, healing is painful and slow, and the results of the cicatricial deformity may be deplorable, involving perhaps loss of the sexual function or control of the bladder. But even when the temptation to use any cauterizing procedure is resisted the result will be disappointing. Recurrence, not of large masses but of numerous smaller vegetations, is certain; all of the wounds will not heal by primary union as the maintenance of a clean field is impossible, and one cannot foresee what will be the ultimate results of the

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cicatricial contraction. If, then, there are other methods of treatment which have any prospect of success they demand careful consideration. Several procedures have been advocated; formalin applied to small areas at a time is effective, but slow and very painful, for which reason I have had to discard it; carbolic acid and chromic acid are useful in the case of small growths, and are most effective when used alternately, but both of these poisons must be used with caution; resorcin and starch in equal proportions make a useful paste, but it is difficult sufficiently to localise its action, and inflammatory irritation may be produced; salicylic acid, 1 per cent, in precipitated chalk is recommended by Taylor as a dusting powder; chloral hydrate solution (1 in 8) has been suggested as a paint; tincture of iodine is another application which has its advocates. In my experience, however, the treatment which has been found to be most simple, effective, and free from objection is the application of lactic acid. The mode of employment will depend upon the condition present. In the male circumcision is performed when necessary, pedunculated warts may be removed with scissors, and pure lactic acid applied to the base after the bleeding has been controlled. Other growths are treated with a continuous 1 per cent wet dressing or the occasional application of a strong solution. In the female, when there are several large masses, each portion is isolated and kept surrounded by strips of lint wet with a  $\frac{1}{2}$  to 1 per cent solution. The base of these growths may in addition be touched at intervals of a few days with the pure acid. Smaller growths are painted with the undiluted acid or a strong solution, and when there is a large field of minute growths the wet dressing is employed. The dressings

are changed as frequently as the amount of discharge necessitates, and at each change the parts are thoroughly bathed with an antiseptic, in the case of females a sitz bath being used. The largest masses wither and drop off, small growths are inhibited, and cure results without the formation of any cicatrices and without pain. The only disadvantage I have encountered in the use of lactic acid is the occasional occurrence of a general erythema when the treatment is pushed too energetically. This erythema is of trifling significance, and quickly subsides on the temporary withdrawal of the acid and the substitution of a zinc and calomel dusting powder or ointment. On this account, however, it may be necessary when large areas are involved to intermit the treatment for two days in each week, and to protect the surrounding healthy tissues with vaseline in order to discourage excessive absorption of the acid. As soon as the seats of gonorrhœal infection—urethra, cervix, rectum, etc.—can be reached appropriate treatment is initiated, and this, combined with strict cleanliness, has an important influence in preventing the appearance of fresh growths.

The histories of a few cases kindly furnished me by Sister Frisby, of the Glasgow Lock Hospital, will illustrate the method and its results.

Case 1.—The patient, aged thirteen, was admitted on September 1st, 1910, suffering from gonorrhœa and medium-sized warty growths in the anal region. The warts were treated by cyllin sitz baths three times daily and application of pure lactic acid once daily. In four days the warts began to improve, and they had completely disappeared in twelve days. Patient was dismissed on September 16th.

Case 2.—The patient, aged twenty-one, five months

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pregnant, was admitted on August 22nd, 1910, with gonorrhœa and numerous warty vegetations on the skin and mucous surfaces of the labia majora. Continuous wet dressing of 1 per cent lactic acid was employed. Improvement was manifest on August 27th, and completed on September 8th. Patient was dismissed on September 10th.

Case 3.—The patient, aged nineteen, was admitted on September 5th, 1910, suffering from gonorrhœa and condylomata acuminata. Large masses covered the vulva and perineum and extended beyond the anus. The whole growth was as large as a medium-sized cauliflower. The patient at first had to be isolated on account of the very offensive odour. She had been previously treated for a short time in another hospital. The growth had appeared and grown with great rapidity three months before admission. After being cleaned up with a  $\frac{1}{2}$  per cent lactic acid solution the masses were separately surrounded with strips of lint soaked in 1 in 100 lactic acid. In two days portions began to drop off, and in seven weeks all traces had disappeared without the formation of any cicatrices whatever.

These cases sufficiently indicate the lines of treatment and the results to be expected in most instances; but certain varieties, especially where complicated with syphilis or tuberculosis, are more resistant. The only claim I make for this treatment is that it is the most generally satisfactory of the many systems with which I have experimented.

## CHAPTER XIX

### GONOCOCCAL CYSTITIS

THERE is little doubt that in practically all cases of posterior urethritis the bladder is exposed to infection by the pus overflowing from the posterior urethra, but the epithelium of the bladder shows a considerable resistance to attack by the gonococcus, and cystitis is accordingly a comparatively rare complication of gonorrhœa.

The condition is more easily demonstrated in the female, as there is not the same objection to the use of the cystoscope. In a recent case of my own occurring in a young woman, during the course of a gonorrhœal infection attention was drawn to the bladder by the amount of pus in the urine and the enormous numbers of gonococci in the urethral smear. Cystoscopic examination of the bladder showed a number of small, raised, bright red areas limited in distribution to the trigone. Swabs taken from these spots gave a pure growth of gonococci.

Superinfection with other organisms, particularly the bacillus coli, streptococcus, or staphylococcus, is prone to occur, and on that account and also because of its painfulness in acute conditions and the danger of inducing complications, cystoscopy is not advisable as a routine procedure. The gonococcus does not cause ammoniacal decomposition.

Characteristic *symptoms* are difficult to find. Some

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of the symptoms produced by the concurrent posterior urethritis may be accentuated, e.g., urinary tenesmus and frequency of micturition; but, on the other hand, these symptoms may not be prominent. A dull bladder pain felt over the symphysis is frequently complained of. If there is any vesical hæmorrhage the blood is intimately mixed with the urine, and has not the terminal character of the hæmaturia of posterior urethritis.

Some rise in temperature and a feeling of malaise are generally present. Assistance in *diagnosis* is got from the three-glass test, but only if applied a short time after a previous emptying of the bladder. In such a case the pus produced in the posterior urethra will not have accumulated in sufficient quantity to have overcome the resistance of the internal sphincter and reach the bladder, and therefore will be discharged with the foremost urine into the first glass. Pus in the second glass is therefore suggestive of cystitis. The third glass, usually considered the prostatic glass, is often very turbid, as in addition to prostatic pus it may contain sedimentary pus from the bladder, or, as Scholtz suggests, pus adhering to the bladder walls expressed by the final contraction of the bladder.

*Treatment.*—A copious flow of bland urine with frequent emptying of the bladder even at night should be encouraged. Atropine should be given to prevent reversed peristalsis and as a sedative. Balsamics and urinary antiseptics combined with *uvæ ursi* or *buchu* are useful. Especially valuable are urotropine and sandalwood oil. Unless contra-indicated the bladder should be flushed out by the Janet method, using a silver solution such as 1-4000 silver nitrate.

Should the case prove obstinate and the cystoscope show areas requiring stimulation, stronger solutions may be instilled.

The female bladder is less exposed to the risk of infection, there being no backward flow of contaminated pus, but cases do arise in practice. Medicinal treatment should be given a fair trial. Thereafter recourse may be had to lavation, and finally, if necessary, affected areas may be treated directly through a Kelly cystoscope with strong silver solutions.

## CHAPTER XX

### GONOCOCCAL INFECTION OF THE KIDNEY

THERE are three paths by which the gonococcus can reach the kidney :—

- (1) By the ureter to the pelvis of the kidney from the bladder ;
- (2) by the blood-stream ;
- (3) by the lymphatic system.

(1) *Direct extension along the ureter* of a non-motile organism like the gonococcus presupposes one of three conditions or a combination of them, viz.,

- (a) reversed peristalsis of the ureter ;
- (b) obstruction to the urinary outflow distal to the bladder and damming back of infected urine ;
- (c) Infection of the ureteral mucosa and direct upward extension of the gonococcal inflammation ; this process might be hastened by ureteral obstruction with the production of a column of stagnating urine.

(2) *Infection through the blood-stream*.—The possibility of the deposition of gonococci in any part of the kidney substance from the circulating blood can be readily understood in view of the frequency of the presence of the organism in the blood and the quantity of blood which is constantly filtering through the kidneys. It is probable that gonococci can be excreted through the kidneys as is known to occur with other organisms. The comparative rarity of kidney

infection proves therefore that the kidney tissues possess an inhibiting action on gonococcal activity. Infected emboli may lodge in the kidney substance during an acute septicæmia.

(3) *Invasion of the kidney through the lymphatic system* is just a possibility. Free intercommunication of the lymphatic plexures surrounding the lower and upper segments of the genito-urinary tract has been demonstrated. In this case the perinephritic region would be the first to be reached. One case of perinephritic abscess in which the gonococcus was found has been described.

Notwithstanding the difficulties in the way of the organism reaching the kidney in sufficient numbers to overcome the natural defences of the organ, a sufficient number of bacteriologically proved cases have been reported to establish the possibility of any given case of kidney disease associated with a gonococcal infection of the genital tract being due to gonococcal nephritis or pyelitis.

*Gonococcal pyelitis.*—Over twenty cases of inflammation of the pelvis of the kidney diagnosed as being due to the gonococcus have been reported. In nearly half of these papers the evidence is inconclusive, a complete bacteriological examination having been unobtainable. Lehr publishes an account of a carefully authenticated case in the "Journal of the American Medical Association," July 6th, 1912, in which he remarks that "this complication of gonorrhœa may be more common than the comparative scarcity of the literature would indicate."

*Symptoms.*—Pain, which may be paroxysmal or continuous, is complained of in the region of the kidney and along the course of the ureter. Pyuria persisting after apparent cure of the lesions in the

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lower uro-genital tract is constantly present. The temperature varies from normal to 103° F., and the pulse ranges round 90.

*Diagnosis.*—Diagnosis can only be assured by finding the gonococcus in a specimen of the ureteral urine. Frequently there is a mixed infection. Cystoscopic examination usually reveals a hyperæmic condition of the trigone, and small red areas of infiltration, especially round the orifice of the affected ureter. From the ureter of the infected side purulent urine will be seen to shoot, while from the sound ureter the escaping urine will be normal. For examination purposes the urine should be collected by ureteral catheter from the diseased side only. It seems undesirable to introduce a catheter through an infected bladder into an apparently sound ureter, although no accidents have been reported as a result of this procedure.

Tuberculosis is excluded by the absence of the tubercle bacillus from the ureteral urine and calculus by X-Ray examination.

*The prognosis* is good, in the absence of septicæmia, if treatment is not too long delayed.

*Treatment.*—Internal medication by balsamics and urinary antiseptics, along with rest in bed and a milk diet, should be given a fair trial. In the event of failure on these lines, lavage of the kidney pelvis through the ureteral catheter is indicated. A solution of one of the organic silver preparations may be used, or preferably a 1 in 1000 solution of silver nitrate. At each sitting, several injections should be given, beginning with 5 cubic centimetres and not increasing beyond 10 cubic centimetres; or a catheter sufficiently fine to allow of a free return flow may be used, and irrigation with 200 cubic centimetres of a 1 in 5000

silver nitrate solution adopted. Irrigation is the superior method, and the strength of the solution can be gradually increased up to 1 in 2500.

*Pyelo-nephritis*.—The number of cases of pyelo-nephritis which are on record is even smaller than of pyelitis. Pyelo-nephritis is probably due to an extension of the inflammation from the pelvis into the substance of the kidney, with resulting single or multiple abscess formation. In addition to the symptoms of pyelitis there may be increased dullness and fullness in the kidney area, and deficient kidney functioning as evidenced by the phenolsulphonephthalein test.

*Treatment*.—Treatment on the lines suggested for pyelitis should be given a prolonged trial unless the patient is losing ground. Nephrectomy or nephrotomy and drainage may be required, especially in cases of mixed infection.

## CHAPTER XXI

### GONOCOCCAL INFECTIONS OF THE EYE

THE eye may become the seat of gonococcal inflammation either by the gonococcus gaining access to the conjunctiva from without or by the organism or its toxins reaching the eye through the blood-stream during the course of a general infection.

*Historical.*—The former mode of infection accounts for the vast majority of cases of gonococcal ophthalmia ; but this, although surmised by an occasional writer, was not generally known previous to the work of Ricord in the middle of the eighteenth century. In the “ *Edinburgh Medical and Surgical Journal* ” of 1807 Benjamin Gibson makes certain suggestions for the prevention of the disease in new-born infants, which show a wonderful comprehension of the subject, and which if they could have been carried out would have saved the sight of innumerable children during the past century. His recommendations were :—

1. The leucorrhœa of the mother ought, if possible, to be cured during pregnancy.
2. When this has not been done, the noxious secretion ought to be removed from the vagina during delivery.
3. The infant's eyes ought immediately after birth to be cleansed with a fluid which either removes the noxious matter or is able to prevent its injurious effects.

Harman, in quoting the above authority (in the "Lancet" of May 24th, 1913), points out that Gibson emphasises the necessity of curing the mother as the most important step in prophylaxis.

Piringer in 1841 showed that gonococcal ophthalmia owed its inception to direct transference to the eye of gonorrhœal pus, and this view was accepted as explaining all cases. Fournier, however, in 1866, reported a case of metastatic gonorrhœal conjunctivitis, and in the year 1881, two years after the discovery of the gonococcus, Heab described a case which he attributed to metastatic infection owing to his inability to find the organism in the secretion.

*Etiology.*—The great majority of cases are due to accidental contamination of the conjunctiva either from sponges, handkerchiefs, towels, bath water, or the hands, or during the passage of the child through the genital tract of the mother; but, as already mentioned, metastasis accounts for a small proportion of the cases of gonococcal eye disease.

The most important group of gonococcal eye inflammations both numerically and ophthalmologically is that included under the term "Ophthalmia Neonatorum." As the conjunctivitis of infants differs in some material respects from the disease as seen in adults, it warrants a separate description.

Ophthalmia neonatorum is in at least 70 per cent of cases due to the gonococcus. That the gonococcus has not been found in this percentage of cases by all observers is due to faulty technique. The other organisms which have been found in the conjunctivitis of infants are the pneumococcus, bacillus coli, Weeks' bacillus, streptococcus, staphylococcus, etc. Two or more of these organisms may be present simultaneously.

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Gonococcal infection of the eye may take place in utero, owing either to premature rupture of the membranes or to penetration of the gonococcus into the amniotic fluid. In these cases the child is born with a well-developed ophthalmia, or the eyes may even be totally destroyed, such is the virulence of the disease in utero. The acute course which characterises the infection in utero is probably due to the even temperature maintained in the conjunctival sac, to the want of drainage if the lids remained closed, and, if opened by the accumulation of pus, to the entrance of the amniotic fluid, which is a suitable culture medium for the gonococcus. Quellmatz (1750) was the first to note the occurrence of intra-uterine ophthalmia. Guthrie (1829), Demours, and Hasse were among the earliest observers of this condition. Sydney Stephenson (1907) collected ninety cases from literature as well as from his own experience. In a few of the cases the children were born "with a caul," thus proving either the placental transmission of the gonococcus or the penetration of the intact membrane by gonococci from an infected cervix. The latter is almost certainly the true explanation of these cases. When infection takes place in the parturient canal, the most dangerous moment is while the eyes are passing over the taut perineum, as the lids at this moment are most liable to become separated.

Inoculation of the eye, however, is much more liable to take place during the cleansing immediately following birth. Gonococcal pus derived from the cervix and adhering to the skin in the neighbourhood of the eyes may easily be washed into the eye by the nurse or rubbed in by the hands of the infant. The bath water is necessarily contaminated, and unless

the water is sufficiently hot to destroy the gonococcus ( $112^{\circ}$  F. or over) it may prove the means of infection.

*Incidence.*—Since ophthalmia neonatorum has now been made a notifiable disease in many towns of America and Britain, it is possible to form some estimate of the prevalence of this condition. Doubtless many cases occur which are not reported to the Health Officer. Thus in Boston, U.S.A., while the disease was listed as notifiable and every effort short of prosecution was tried to obtain the notification of cases, it was known that the law was disregarded, an average of only 10 cases per month being certified. A test prosecution raised the number to 20 during that particular month, but during the following month the number lapsed again to 10. A series of fresh summonses caused a consecutive rise during the first four months of 1911 to 15, 32, 97, and 116 respectively. The last number proved thereafter to be about the monthly average for that city, there being in 1911 1068 cases of ophthalmia neonatorum reported. London adopted notification in March, 1911, and the report for the year 1911 (published February, 1913) states that 673 cases were notified in  $9\frac{1}{2}$  months, which would give 850 cases per annum. The number of births (less still-births) during the same year was 100,830. This gives an incidence of 0.843 per cent, which is undoubtedly considerably below the correct figure. The experience of the Health Authorities in Glasgow is given in a report published February, 1913, which covers a period of 17 months' working of the system of notification. In that time 341 cases were reported, which represents 0.94 per cent of the live births.

Gonococcal ophthalmia is responsible for the im-

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pairment or loss of vision in one-third of the children in asylums and schools for the blind.

*The incubation period* is short. Evidence of the disease is as a rule well established in 48 hours. The prevalence and the serious import of this disease has now aroused the attention of the medical profession, and both doctors and nurses are taught to look for the development of symptoms suggestive of its onset, in every puerperium for the conduct of which they are responsible. It is now recognised that draughts, colds, etc., are not the cause of ophthalmia of the new-born, although they may be factors in the onset of some of the 25 to 30 per cent of cases not due to the gonococcus. In the present state of our knowledge the attendant who belittles or neglects a beginning inflammation of an infant's eye is incurring responsibility of the gravest sort. Therefore the "period of incubation" should be reduced to its narrowest limits, the earliest stage of inflammatory reaction noticed, the organism at once searched for, and treatment begun.

When invasion of the conjunctival sac has taken place in the uterine cavity, the disease, as has already been mentioned, may be well established at the date of birth and noticed at the first inspection of the child. When infection has occurred during parturition, symptoms may supervene within the first or second day after birth and almost certainly within three days. Inflammation starting after the third day is probably due to the infection reaching the eye subsequent to birth (secondary infection). But any given incubation period will vary with the precision with which the eyes of the child have been observed. The disease is as a rule well established on the third day, and gross symptoms are present thereafter.

The scrutiny of the eyes must not be relaxed until after the disappearance of the lochial discharge, as at any time during the puerperium the infant may become infected by careless or unclean procedure on the part of the mother or nurse.

*Symptoms.*—The earliest symptoms are those mainly of irritation, viz., redness of the conjunctiva and an excess of serous secretion. The redness increases and spreads, the secretion becomes purulent and glues the eyelids together. On separating the lids, which has to be done after bathing with warm solution and with the greatest gentleness, pus freely exudes. The eyelids become swollen and oedematous. In untreated cases the inflammation proceeds to



FIG. 72.

All-rubber goggles. Illustration supplied by Dunhills.

ulceration of the cornea and sloughing with resulting opacity and defective vision or total blindness, and in many cases with destruction of the eyeball.

The disease may start in one eye or coincidentally in both; but it is seldom that the condition in untreated cases is confined to one side for many days.

In examining a child in whom the disease is well advanced, the infant's head should be placed between the aproned knees of the surgeon while the body is held by a nurse. Rubber gloves should be worn, and it is a useful precaution for the attendant's eyes to be protected by goggles. The lids are bathed in warm solution to remove crusted secretion. The utmost delicacy of touch must be exercised in overcoming the spasm of the orbicularis so as to avoid the

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risk of pressure on the eyeball causing perforation of a corneal ulcer, which may be near the point of rupture. On opening the eyelids the surgeon must be prepared for and avoid spurting out pus. Before the eye can be examined the pus must be carefully removed by washing.

The palpebral conjunctiva will be found deeply congested, especially in the lower fornix. As a rule the ocular conjunctiva is affected in a less degree, and chemosis is absent in infants, probably owing to the constant closure of the eyelids. As has been previously indicated, ulcers may be found on the cornea, in which case a most guarded prognosis should be given.

*Diagnosis.*—An inflammation of the infantile conjunctiva of increasing severity and soon associated with the formation of thick creamy pus is probably gonococcal; but the diagnosis is assured by finding the causative organism.

The manner in which the specimen for microscopical and cultural examination is prepared is of the greatest importance. A platinum spoon or a probe wrapped round with sterile cotton-wool may be chosen. In either case, the palpebral conjunctiva of the everted lower lid is curetted or wiped gently but firmly to obtain its adhering secretion. This is implanted on sloped tubes of serum agar, and in addition it is smeared on a slide for immediate staining by Gram's method. Obtained in this way, the specimen will rarely fail to show the gonococcus if it is present. The intracellular habit of the organism is not so clearly shown by this method as in examining a drop of pus, but many typical extracellular, Gram-negative, coffee-bean-shaped diplococci are usually located without difficulty.

*Prognosis.*—The prognosis depends almost entirely

on the stage at which the disease comes under treatment. If sloughing ulcers of the cornea are present the outlook as regards cure without impairment of vision is bad. In children with the additional burden of congenital syphilis, the prognosis is grave indeed.

*Prophylaxis*.—Thanks to the initiative of Credé, the importance of prophylaxis now receives a certain proportion of the recognition to which it is entitled. But full value will only be got from prophylactic measures when each supposedly skilled attendant recognises his or her personal responsibility for the safety of the child's eyes, and understands that practically every case is preventable.

In the first place, it should be part of an obstetrician's routine to inspect the cervix of each pregnant patient through a speculum, and if pus is present to have it bacteriologically examined. At the same time, the urethra should be emptied of any contents by digital pressure from above downwards through the vagina, and if any pus is detected a urethral smear should be examined. This procedure would conserve both the interests of the child and the mother by enabling treatment appropriate to the particular organism to be initiated, and many cases of puerperal fever as well as of ophthalmia would be prevented.

Short of inspection of the cervix, the practitioner should at least assure himself by cross-examination at the time when he is engaged of the absence of vaginal discharge. If he elicits any ground for suspicion, the necessity for further information should be insisted on.

The treatment required for gonorrhœa in pregnancy will be found in the relative chapter. In those cases in which treatment previous to the onset of labour has been neglected or has proved ineffectual, and in

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which a purulent discharge is still present, an antiseptic vaginal douche should be given during the second stage of labour, as is the rule in the Rotunda Hospital, Dublin.

### THE TREATMENT OF OPHTHALMIA NEONATORUM

The nature of the prophylactic treatment which should be adopted for the child's eyes depends on whether the presence of parental gonorrhœa is suspected or not.

1. When gonococcal infection of the mother is not suspected, the following general rules apply and should be adopted at every birth :—

- (a) The eyelids and eyelashes, if possible before the eyes have been opened, should be thoroughly wiped free of all adhering mucus, etc., by means of several clean pieces of soft linen or cotton-wool. The first swabs may with advantage be moistened with saline solution or boric lotion, but no solution should reach the inside of the eyes, and the cleansing should be completed with dry swabs.
- (b) The nose and mouth should next receive attention, and the child's hands also cleansed lest in rubbing the eyes the fists should re-implant contagious material.
- (c) Clean bath water should be used for the head and face after the body toilet is completed.

The universal adoption of the Credé's method of instilling a 2 per cent silver nitrate solution into the eyes has been frequently urged, but as a certain amount of irritation follows the application of this solution, and

as the simple procedure described above is found to be sufficient except in very occasional cases, a more rigorous routine treatment is undesirable.

2. When, on the other hand, gonorrhœa in either of the parents is known to have been present, or is suspected on account of the presence of purulent vaginal or urethral discharge or the history of eye trouble in a former birth, an additional precautionary measure is essential, viz., to instil into each eye some antiseptic which can be expected to destroy all the gonococci which may have gained entrance into the eyes. The ideal antiseptic would be one which had a special affinity for the gonococcus, and could be put into the eye in an active gonococcicidal strength without damage to the sensitive infantile conjunctiva.

Silver nitrate is the antiseptic on which most reliance has been placed, but the 2 per cent solution suggested by Credé is now generally discarded on account of its too irritating properties, and when the silver nitrate is used at all 1 per cent is the strength recommended. Stephenson directs that one drop of 1 per cent solution should be placed in each conjunctival sac as soon as possible after birth of the head and the cleansing of the eyeballs. It is not necessary to evert the lids.

In preference to the silver nitrate, many authorities rely on one of the organic silver preparations on the market. Unfavourable criticisms of these proprietary articles have been published by workers who felt it necessary to refute the too optimistic advertising matter scattered broadcast by some of the firms owning the compounds; but the balance of opinion seems to support the value of the organic silver

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preparations on account of their antiseptic and penetrating qualities combined with the minimum of caustic action on the tissues.

Darier of Paris advocates the use of argyrol as a prophylactic. After thorough external cleansing, five or six drops of a 10 to 15 per cent solution should be dropped between the opened lids and the margins of the lids brushed with the fluid. The solution should be prepared by scattering the dry powder on cold water and allowing it to dissolve. A drop of a satisfactory solution run over a glass surface leaves a track the colour of tincture of iodine. If the smear, on the other hand, is watery and contains granules, such a suspension in the eye would obviously create irritation. Protargol or sophol, 5 per cent, may be similarly employed.

*Treatment.*—The main essential in the treatment of ophthalmia neonatorum is frequent and thorough flushing of the conjunctival sac. No pus must be allowed to accumulate or corneal complications with their serious effects on vision are almost sure to arise. In addition to washing out the eye every two hours or more frequently, an organic silver solution should be instilled every four hours.

The lotions used for washing the eyes are sodium chloride (1·4 per cent); boric acid (saturated solution); mercury oxycyanide (1 in 4000); mercuric chloride (1 in 8000); potassium permanganate (1 in 3000). Stephenson recommends that previous to douching, the eye should be filled with hydrogen peroxide (perhydrol, Merck), either in full strength or with equal parts of water. The pus is decomposed with evolution of gas and wells up from the fornices, thus promoting its easy removal by the solution, which is afterwards allowed to flow over the eye.

For washing out the eye an "undine," i.e., a glass flask with pointed spout, the latter protected with a short length of soft rubber tubing, is the handiest and safest appliance. If an irrigator is used the vessel should be no more than a foot above the level of the eye and the flow should be gentle and regular. Syringes are objectionable. The intervals at which the eye should be washed out depend on the rapidity with which pus forms, but in a case which is well under control, every two hours night and day is the usual routine.

As a gonococcicide, silver nitrate, 10 grains to the ounce of distilled water, has been largely employed; but to obtain the full benefit of this application the eyelids must be everted and the solution painted over the exposed conjunctiva. When simply dropped into the eyes the effect of the nitrate is limited practically to the uncovered area. All power of penetration is inhibited by conversion into the inert chloride through a chemical reaction with the sodium chloride of the tears and secretion. To evert a small œdematous eyelid is often a difficult and painful undertaking, and in any case is properly only the work of the medical attendant and not of the nurse, and therefore the usefulness of the silver nitrate is limited.

The organic silver compounds are free from the difficulties attached to the use of the inorganic silver salts, and are much more readily diffused over the conjunctival surface. Argyrol (25 per cent), protargol, sophol, etc., in the form of drops may be employed every few hours after all pus has been washed out. In cases which do not respond to argyrol, recourse may be had to a 2 per cent silver nitrate solution applied as a paint by the surgeon.

The treatment must be kept up until all pus

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formation has ceased, and until gonococci are absent from smears prepared according to the method already described. Usually about six weeks of this treatment are required.

For corneal complications a few drops of eserine sulphate solution (2 grains to the ounce) are dropped into the eye three or four times a day in addition to the above treatment, and, failing speedy improvement, the affected parts may require to be cauterized by means of the galvano-cautery.

If only one eye is infected the sound eye should be protected with a cyanide gauze dressing, but it must be frequently inspected for signs of beginning disease.

*Gonococcal conjunctivitis in the adult* in the vast majority of cases is due to the implantation of the organism on to the conjunctiva through the medium of the hands, handkerchiefs, towels, or bath water. Every patient with urethritis should be warned of the risk of conveying infection to his own or other people's eyes.

Gonococcal conjunctivitis is marked by its acuteness and the amount of pus formation, but the diagnosis depends on the demonstration of the gonococcus in the discharge. The symptoms appear in from one to three days after infection. The disease is usually limited to one side and is more frequently found in the male. The eyelids are hot, swollen, and œdematous. The discharge is at first thin, serous, and perhaps blood-stained, but in forty-eight hours it is markedly purulent. Chemosis, rare in the infant, is a feature of the disease in the adult. The œdema of the conjunctiva tends to produce a sulcus round the limbus in which pus collects, and the digestive action of its toxin will, if allowed to continue, quickly destroy the cornea. The necessity for the constant

washing away of the pus is thus even more urgent than in the child.

Hosford and James ("Lancet," January 13th, 1913) recommend continuous irrigation with a solution of permanganate of potash (1 in 20,000). The douche is placed one foot above the level of the recumbent patient; a fine rubber tube is strapped above the inner canthus of the eye in such a manner that a gentle continuous stream will flow along the palpebral fissure. The patient should open his eye every ten minutes. The sound eye is protected with a Buller's shield. Eight days of this treatment is said to control the most severe cases. The patient, of course, lies on the infected side. The main disadvantages of this otherwise admirable method is the interference with the patient's sleep, but the authors say that a few hours at a time is usually obtained, and, if necessary, hypnotics can be administered.

In the absence of continuous irrigation, hourly rinsing is necessary, and four-hourly instillation of silver as described for ophthalmia neonatorum.

*Corneal complications* are more severe, and more frequent in adults than in children. They may occur early or late in the disease. When there is much chemosis, the early and dangerous form of ulceration may be anticipated. The first symptoms of involvement of the cornea is the appearance of a dull grey spot either in the interpalpebral or the central zone of the cornea. This area usually develops into an ulcer which may be either clean looking or yellowish. In the latter case it is likely to penetrate the cornea with the result that a staphylloma is produced. Ulcers forming later in the disease may be central or peripheral, but they are more amenable to treatment than the earlier forms.

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Atropine (2 grains to the ounce) or eserine is a necessary addition to the treatment when the cornea becomes implicated, and the galvano-cautery may be required for sloughing ulcers.

Arthritis or any of the other evidences of infection of the blood may arise during the course of gonorrhœal conjunctivitis.

*The use of heat as a gonococcicide in gonococcal ophthalmia.*—The fact that some strains of gonococci are destroyed by exposure for ten minutes to a temperature of 44° C. (111° F.) and immediately at 45° C. (113° F.) suggests the possibility of using heat as a method of treatment.

Goldzieher, of Budapest, has reported excellent results in a series of cases ("Wiener Klinische Wochenschrift," 1911, N. 47). He devised a portable instrument by means of which a jet of steam can be directed against the conjunctiva of the everted lids and also the ocular conjunctiva. This instrument is electrically heated by connecting with a wall plug and easily handled so that the distance of the spout from the eye can be altered as desired.<sup>1</sup>

It has been found by experiment that the steam jet from this kettle when allowed to play on a sheet of paper (representing the conjunctiva) produces at the distances given the following temperatures :—

Close to the spout	.	.	.	.	80° C.
At a distance of 0.5 c.m. from the spout	.	.	.	.	66° „
1	„	„	„	.	64° „
1.5	„	„	„	.	60° „
2	„	„	„	.	56° „
2.5	„	„	„	.	54° „
3	„	„	„	.	52° „
4	„	„	„	.	45° „

<sup>1</sup> This apparatus is made by D. Szikla, Rakoezyut 19, Budapest.

The spout is therefore held 3 to 4 centimetres distance from the eye, but it can be brought as near as 2.5 centimetres.

The use of moist heat is much less likely to be followed by injury than would dry heat. There is, however, considerable pain experienced, especially with the first application, and the pain is not obviated by the use of cocaine. Gonococci are absent after three or four daily applications, and the remaining congestion is sufficiently treated with 0.5 per cent zinc sulphate solution. Further reports of the heat treatment by this or other methods will be awaited with much interest, as the treatment is based on a rational and scientific foundation.

*Metastatic gonococcal eye disease.*—Iritis or iridocyclitis may appear as a feature of a systemic gonococcal infection. It shows a tendency to recur with each fresh attack or relapse of urethritis. It is usually mild, in which case it is frequently overlooked, or it may be severe and compel attention. The pupil should be examined with reference to its mobility in all cases of gonorrhœal rheumatism, and if any degree of iritis is discovered full dilatation should be secured and maintained by the use of atropine. Apart from the local use of atropine, the treatment consists of treating the urethritis.

Metastatic conjunctivitis, apart from the slight conjunctival involvement which may accompany iritis, is a rare condition, but several cases have been reported which, from their mild clinical course, scarcity of gonococci in the secretion, and the presence of a concurrent arthritis, have been diagnosed as being of metastatic origin. There is always the possibility of error in concluding that a conjunctivitis is of endogenous origin (really a sub-conjunctivitis), as the

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blood infection which must be present in these cases may be accompanied by the formation of antibodies in such quantities as to inhibit the activity of the organisms which have reached the conjunctiva from without, and thus a clinical picture may be produced which is indistinguishable from true metastatic conjunctivitis. The diagnosis depends on the bilateral simultaneous involvement of both eyes, the slight amount of mucoid discharge, the slight swelling of the lids, the moderate chemosis, the absence of gonococci in the discharge, and the evidence and history of a systemic infection.

*The treatment* consists of active treatment of the urethritis, with, locally, argyrol and atropine.

*Gonococcal choroiditis*.—A case of choroiditis is reported by Vandegrift ("Journal Amer. Med. Ass.," 8.6.12). "The clinical picture was that of a localised chorio-retinitis attended by a severe hyalitis." It was associated with a gonococcal prostatitis, and was cured by a mixed gonococcus and staphylococcus vaccine in large doses.

## CHAPTER XXII

### GONORRHŒAL RHEUMATISM

UNDER this term it has been customary to include acute and chronic inflammatory conditions due to metastatic implantation of the gonococcus in the synovial membrane of joints, tendon-sheaths, bursæ, etc.

*Historical.*—Various early writers are said to have noticed the association of rheumatism with gonorrhœa. Certainly the conjunction was observed by the keen eye of John Hunter, who writes in 1716: “I know one gentleman who never had a gonorrhœa but that he was immediately seized universally with rheumatic pains, and this had happened several times.” According to Murrell (“Practitioner,” January, 1912), the credit of being the first to establish gonorrhœal rheumatism as a definite disease belongs to Sir Benjamin Brodie, who, in his “Pathological and Surgical Observations on Diseases of the Joints” (1818), gives a detailed description of five authentic cases.

*Incidence.*—Different observers have estimated that rheumatism occurs in from 2 to 10 per cent of cases of gonococcal infection. It is difficult to arrive at anything approaching an accurate conclusion on this point, mainly because so many cases of gonorrhœal rheumatism escape recognition as such, owing to the suppression of, or in females the want

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of knowledge of, a history of gonococcal infection. Even where the suspicion arises, that in a given case the gonococcus may be the primary cause of the condition owing perhaps to the want of response to salicylate treatment, the diagnosis may remain in doubt in the absence of gross urethral discharge. But, as will be shown, careful analysis of the symptoms and history, and a properly guided search for the gonococcus will clear up the real nature of many obscure cases of rheumatic complaints. The incidence of rheumatism as experienced in any class of well-treated patients such as soldiers (1·7 per cent, Pollock and Harrison), shows what it may and ought to be reduced to, but gives no suggestion of the ordinary prevalence of this complication. It is usually maintained that males are much more liable than females. While admitting a somewhat greater incidence and a decidedly greater morbidity in males, it must be recognised that the disease is frequent in females, and many cases of chronic rheumatism in women are due, as is the case in men, to an uncured focus of infection in the urogenital tract. In young girls, the tendency to rheumatism is more pronounced than in adult females ; it may follow either vulvo-vaginitis or ophthalmia neonatorum. Previous attacks confer no degree of immunity, but on the contrary, the patient is extremely susceptible to a recurrence of the joint affection with any relapse of the urethritis or on reinfection. One or several joints may be affected. In order of relative frequency the joints involved are the knee, ankle, wrist, fingers and great toes, elbow, shoulder, hip, temporo-maxillary. Some joints which escape in ordinary acute rheumatism may be invaded by the gonococcus, e.g., the sterno-clavicular, costo-sternal, sacro-iliac, intervertebral,

temporo-maxillary, and tarsal articulations. Tenosynovitis and periarticular tenderness are common and should excite suspicion as to the nature of the case.

*Predisposing causes.*—Metastasis is prone to occur at any time after the extension of a urethritis to the posterior urethra, and the joints most likely the first to be involved are those that are most liable to suffer from injury, strain, or fatigue. A chill during the course of a urethritis may determine the onset of a rheumatic attack. Digglemann has noted the tendency of the gonococcus to attack joints which have been affected in an antecedent acute rheumatic fever.

*Pathology.*—The gonococcus reaches the synovial membrane by the blood-stream. It becomes located in the endothelium and subendothelial tissues, and there sets up an inflammatory reaction. Round-celled infiltration of the tissues, œdema, and sero-fibrinous effusion follow. Later, adhesions are produced which limit the movements of the parts. The gonococcus can be recovered from the effused fluid and from scrapings of the synovial membrane. It is advisable to procure if possible several cubic centimetres of the fluid for plating purposes, as the organism is usually but sparsely distributed in the effusion. On one occasion, 1 centimetre, all the fluid obtainable from a tender knee joint, showed only one colony after forty-eight hours' incubation (Martin).

The inflammatory process may proceed to the formation of sero-pus; secondary infection by a staphylococcus, streptococcus, or bacillus may supervene, in which case erosion of the cartilage and destruction of the joint may be expected unless the joint is opened and free drainage maintained.

*Onset.*—Metastatic symptoms may arise at any

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time during an acute or chronic gonococcal infection. So long as there is a site in which the gonococcus survives there is the ever-present danger of blood invasion either direct or through the lymphatic system. Arthritic symptoms, however, most commonly appear in the third week of an acute infection, i.e., when the disease has reached the posterior urethra, but they have appeared as early as the fifth day and as late as the seventh year after infection.

*Classification.*—Osler remarks that variability and obstinacy are the most distinguishing features of gonorrhœal rheumatism, and he describes as the most important of the possible variations the following clinical forms :—

1. Arthralgie, in which there are wandering joint pains with redness or swelling.
2. Polyarthritic, with involvement of several joints, as in subacute rheumatism.
3. Acute gonorrhœal arthritis, in which a single articulation becomes suddenly involved.
4. Chronic hydrarthrosis, usually mono-articular and particularly liable to involve the knee. It comes on often without pain, redness, or swelling.
5. Bursal or synovial form. Attacks the tendons and their sheaths, bursæ (e.g., of the patella, the olecranon, or the tendo-Achilles), and periosteum. The articulations may not be affected.
6. Septicæmia, in which the patient is acutely ill with symptoms of an intense septicopyæmia usually with endocarditis.

Keyes accepts two main divisions :—

- (a) Gonorrhœal arthritis, in which the organisms are located in the joint itself.

- (b) Gonorrhœal osteo-arthritis, in which the gonococci are localised in the articular extremities of the bones, and any effusion into the joints is secondary. The cartilages in this type are liable to become eroded, and bony ankylosis may result or spurs may be formed by periosteal proliferation.

These two conditions may be differentiated by the appearances shown in a radiograph; where osteo-arthritis is present, bone rarefaction is always manifest within a week.

*Symptoms.*—In the acute type the onset is sudden, with a rise of temperature to 100° or even 103° F., pain and swelling of any joint, but most commonly the knee, spreading in a day or two to one or two other joints (rarely three or four). There is at first but little redness over the joints, sweating is not noticeable, and pain is not extreme except on movement. There is, however, marked tenderness on pressure, some thickening of the synovial membrane, and some effusion into and around the joints. During the height of an acute attack the urethral discharge may disappear.

Under appropriate treatment this condition may quickly resolve and leave no permanent ill-effects. On the other hand, the inflammatory reaction may become intensified, tendon sheaths and bursæ become involved, effusion into the joint and periarticular œdema increase with the appearance of purple areas over subcutaneous tendons. The results of the latter condition are too frequently permanent adhesions and immobility of the affected joint with atrophy of the muscles of the limb.

*In the chronic type* the symptoms suggest an intermittent or continued blood invasion from some latent

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focus of infection, commonly the vesiculæ siminales or Fallopian tubes. Several joints are affected sooner or later, prominent among them being the knee with a tender spot over the internal lateral ligament, the tarsal joints with painful heels and tendency to flat foot, the wrist and its overlying tendons, etc. Even in cases of chronic monoarticular hydrarthrosis, a careful inquiry will usually elicit a history of transient pains in other joints. Sweating and "clamminess" is frequently complained of, and these patients tend to develop more or less neurasthenia. If there is no effusion in or round a painful joint the pain may be due to an adhesion, the accidental or voluntary severance of which may be followed by permanent relief.

A patient may be completely crippled by chronic gonococcal arthritis with adhesions and ankylosis. He may suffer from an associated anæmia and debility with progressive loss of weight and strength until life becomes a burden.

Severe headache suggests meningeal implication, or it may be due to beginning eye trouble. Endocarditis or pericarditis may develop at any moment during a gonococcal systemic infection with or without joint symptoms, but heart complication is much less common in this disease than in ordinary acute rheumatism.

*Diagnosis.*—Gonococcal is distinguished from other forms of rheumatism by certain clinical points as well as by the discovery of the causative organism. In addition to the failure of the case to respond to salicylate treatment, the small number of joints affected, and the implication of joints that usually escape in the other types (e.g., the sterno-clavicular, the temporo-maxillary, sacro-iliac, chondro-sternal, etc.) will assist the diagnosis. Again, the tendency to

periarticular infiltration and tenderness and to involvement of the tendon sheaths and bursæ, as well as the absence of profuse sweating and of diffuse redness of the skin over the affected joints, would suggest the necessity for investigating the condition of the uro-genital tract. In the male, if gross pus be absent it will in most cases be sufficient to examine, by the separate glass method, the morning urine or at least urine which has been retained in the bladder for some hours. The presence of pus in flakes or threads suspended in the urine will prove the persistence of a resolving or chronic urethritis, and a search for the gonococcus will then be necessary. An attempt to cultivate the gonococcus or to find it by microscopic examination of a smear must in such cases be preceded by massage of the seminal vesicles and prostate and expression of their secretion along the urethra to the previously cleansed meatus. Several smears may have to be examined and several culture tubes seeded before success is obtained in the most chronic cases, but care and perseverance will usually be rewarded.

In the female, the urethra and cervix must both be included in the search for the gonococcus. After thorough cleansing of the cervix and vagina the tubes and uterus are examined by bimanual palpation, and the cervix is again displayed and cleansed with dry sterile swabs. The handling of the parts has probably expressed some material from the upper passages and this should be examined. As a rule, however, the gonococcus is more readily got from the cervical glands by rotating a wool-wrapped probe within the os while exerting some pressure on the cervix. The urethral smear may be positive even when those obtained elsewhere are negative. Skene's ducts, the

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vulvo-vaginal, and other glands should be scrutinised, and para-urethral passages looked for.

In chronic cases where difficulty is experienced in demonstrating the gonococcus which there is good reason to suspect is still somewhere present, a diagnostic injection of vaccine may be used twenty-four hours before the preparation of the smears.

In the event of failure to isolate the organism from the uro-genital tract it may be desired to test the joint effusion. For this purpose, under strict asepsis, the joint is penetrated by the needle of a 10-cubic centimetre syringe, and as much fluid as can be obtained withdrawn. This is plated with 2 per cent agar melted and cooled to 40° C., adding, if sufficient fluid be available, one volume of effusion to two of agar. In the event of no colonies appearing within forty-eight hours, failure should not be assumed, as growth may be delayed for several days. Another method not open to the risk of destroying the gonococcus by the heated agar is to run a small quantity of the fluid over a series of plates or tubes of ascites agar; or growth may be attempted by adding the joint contents to ascites broth.

Apart from the discovery of the gonococcus there are other tests which will assist or secure a correct diagnosis. The most valuable is the complement deviation test, which is always positive in gonococcal rheumatism. The skin reaction is also helpful. These points are fully discussed elsewhere.

There should therefore be no difficulty in ascertaining definitely in any doubtful case of rheumatism whether it is of gonococcal origin or not. It should not be forgotten that a patient may suffer from two infections, gonorrhœal urethritis and acute rheumatic fever.

*Prognosis.*—The prognosis, if treatment is submitted to, is good so far as the prevention of further damage to the joints is concerned, but it is doubtful so far as recovery of disabled joints is concerned. However, once the disease has been stayed, as it can be by appropriate treatment, it may be possible by the freeing of adhesions, massage, hot air, etc., to restore a joint to usefulness which when first seen looked hopeless. An X-ray photograph may indicate what possibility of ultimate cure remains.

*Treatment.*—Apart from the immediate relief of pain and apart from surgical treatment, the main indication is by suitable means applied to the primary area of infection to prevent further contamination of the blood-stream. It is in gonococcal rheumatism that the most definite and satisfactory results have been reported from the use of gonococcus vaccines. For remarks on vaccine therapy, reference may be made to the special chapter on immunity reactions.

In acute conditions the patient will require treatment in bed. The most useful agent in the relief of pain is immobilization of the joint, for which purpose moulded splints with a considerable amount of cotton-wool to ensure the exercise of a gentle elastic pressure should be employed. If the pain is not sufficiently reduced by fixation of the joint, hot fomentations may prove soothing, or the application of equal parts of extract of belladonna or of ichthyol and glycerine may be tried. The Bier treatment or exposure of the joint to hot air are each of service. The tendency to the formation of adhesions must be kept in view, and passive motion resorted to for the maintenance of free movement; but too early or too forcible passive movements may stimulate into activity a declining

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synovitis. Massage is of much value in delaying the muscular atrophy which is such a constant feature of prolonged gonococcal arthritis. Counter-irritation is valuable both in reducing the inflammation and allaying pain, and the most effective method of applying it is by light scarification with the galvano-cautery. The usual anti-rheumatic internal remedies are absolutely useless in this complaint, and restrictions of diet also have not the same significance. Deformities and loss of function have to be treated according to the rules of orthopædic surgery.

Queyrat (*vide* "Lancet," October 12th, 1907), with special reference to cases of gonorrhœal arthritis of the knee, recommended a method of treatment which he maintained, if begun early, will result in cure and complete restitution of function within three weeks. His principles are early aspiration, energetic counter-irritation, and early movement. Aspiration is performed on the outer aspect of the knee two fingers' breadth behind the patella with careful aseptic precautions. He performed this operation over 200 times without untoward result. After the paracentesis of the joint he applies the point of the actual cautery, making 200 to 400 punctures (200 à 400 *pointes de feu*), and follows this by methodical pressure. Four days later he starts progressive movements, using a special apparatus with a weight-lifting attachment.

Felix-Ramond ("Bulletins de la Soc. Med. des Hôpitaux," November 10th, 1913) reports good results from auto-serotherapy as suggested by Gilbert, of Geneva, for pleurisy with effusion. From 3 to 5 cubic centimetres of the arthritic fluid is aspirated into the syringe. The needle is withdrawn from the joint and the fluid reinjected subcutaneously. He states

that the gonococcus was absent from the effusion, but this is open to question. No ill-effects, however, resulted in his six cases and satisfactory cures were quickly obtained. When the effusion was purulent the dose was reduced to 1 cubic centimetre in the first treatment, increasing to 3 cubic centimetres in the second. Injections were repeated every two or three days during eight to ten days. This treatment has a parallel in the sensitized vaccine method.

Intravenous injections of colloid silver have been favourably reported upon by some German surgeons.

Fuller, of New York, maintains that in a large proportion of cases of gonorrhœal rheumatism in the male, the local focus from which systemic infection is maintained and which is responsible for the persistence of the arthritic symptoms is the vesicula seminalis. He therefore treats these cases by radical surgical measures, opening the diseased sacs and draining them through a perineal wound. In this way he has attained remarkable success in otherwise intractable cases.

## CHAPTER XXIII

### GONOCOCCUS SEPTICÆMIA

THAT the gonococcus, in many cases of gonorrhœa, finds at least temporary lodgment in the blood-stream is proved by the occurrence of metastatic symptoms, e.g., arthritis. The probability is that invasion of the blood-stream is frequent, but that only in a small percentage is metastatic deposition of the organism in the various susceptible localities accomplished and a diseased condition produced. In a still smaller proportion of cases does the presence of the gonococcus in the circulating blood give rise to symptoms of acute septicæmia. It would appear that the blood of the average individual possesses sufficient natural resistance to the gonococcus to prevent its propagation in quantity sufficient to produce definite evidence of systemic intoxication. On the other hand, cases occur which prove that this immunising power may occasionally be wanting, and in such cases serious symptoms arise which can be attributed to the blood condition alone, apart altogether from the absorption of toxins from areas where a gonococcal inflammation may be in activity.

This condition has been described by different writers under the names of gonococcal sapræmia, gonococcal pyæmia, gonopyæmia, gonococcæmia, and gonohæmia. The first to separate the gonococcus from the blood-stream was Hewes, who, in 1894, suc-

ceeded in isolating the organism from blood procured from a case of gonococcal arthritis. Lofaro ("Il Policlinico, Sez. Chirurg.," Rome, 1911, xviii, 49) discusses the literature of systemic infection, and gives his own findings in sixty-seven cases. Lofaro's method is to take 10 cubic centimetres of blood from the median basilic or other suitable vein, mix two or three drops with one tube of ascitic broth and 5 to 8 cubic centimetres with another similar tube. These tubes are incubated at 37° C. for forty-eight hours, when more ascitic fluid is added and the contents plated with an equal quantity of ordinary agar. The colonies are counted in forty-eight hours and smears made for microscopical examination, but it should be remembered that colonies may appear as late as the fifth day of incubation. Of the sixty-seven bloods investigated, thirty-nine gave positive results. In all the cases (eight) of acute gonorrhœa, meaning within thirty days of infection, the blood was sterile. Of twenty-six cases complicated with epididymitis, colonies of gonococci were obtained in nineteen. Eleven positive findings were obtained out of nineteen cases of chronic urethritis. Lofaro believes that the gonococcus reaches the circulating blood through the lymphatic system, and this is probably true of many cases; but in others direct entry into a blood-vessel associated perhaps with venous thrombosis is the origin of the systemic infection.

*Classification and etiology.*—The expression "gonococcus septicæmia" is here used to indicate those cases in which the blood condition dominates the clinical picture, and any complication such as joint or heart involvement is secondary not only in sequence, but in significance. The gonococcus gains the circulating blood through injury or disease of a

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blood-vessel wall or through the lymphatic system. Owing to a deficiency in the protective powers of the individual, an intoxication is produced which may either run a short acute course ending in recovery or death, or become chronic with a liability to exacerbations. In the latter case the condition is probably kept up by a series of reinfections from the original source of supply.

Several rapidly fatal cases have been reported in which neither during life nor post-mortem were there any signs of metastatic disease, and in which the diagnosis depended on the positive results of the blood-cultures. Many obscure cases of septic intoxication, resembling typhoid but not giving its characteristic reaction, escape recognition of their true etiology, owing to the want of a careful and thorough bacteriological examination of the blood. The gonococcus will, of course, be missed unless a medium suitable for its growth is chosen, and this is too seldom done unless a special search for the gonococcus is requested.

*Predisposing factors.*—Those which have been recognised are traumatism (especially unskilful instrumentation), alcoholic and venereal excesses, menstruation, pregnancy, and such conditions of the general system as lower the powers of resistance, e.g., diabetes and tuberculosis.

*Symptoms.*—In acute gonococcal septicæmia the symptoms are characteristic of invasion of the blood by a pathogenic micro-organism. Following a rigor, the temperature rises to 103° F. or more, with irregular fluctuations thereafter. The temperature chart may be similar to that of typhoid fever or of a pyæmia, or it may be governed by no regular periodism whatever. Malaise, headache, furred tongue, thirst, profuse sweating, anorexia, vomiting,

diarrhœa, and death is the usual sequence in the severest cases. The disease may simulate and be mistaken for typhoid, malaria, or ulcerative endocarditis. The spleen is frequently enlarged, the liver may be felt below the costal margin or it may be atrophic with symptoms of jaundice. Albuminuria and cutaneous eruptions or petechiæ are not uncommon.

In chronic cases the symptoms are less severe; in fact, it is probable that many mild cases are overlooked entirely or mistaken for toxæmias. It is not uncommon to get a history of continued nightly rises of temperature with vague feelings of uneasiness in limbs and back, sweating, breathlessness, and cardiac weakness. In many of these cases it is difficult to say whether the symptoms are due to absorption of toxins from a local lesion or to a partially controlled septicæmia.

*Diagnosis.*—The diagnosis is wholly dependent on the isolation of the organism from the patient's blood. It should not require a knowledge of the presence of a concurrent gonorrhœa to direct attention to the possibility of the gonococcus being the offensive agent in an obscure septicæmia. The gonococcus being one of the most common disease producers, all blood examinations for unknown infecting agents should include a search for this germ. Examination of the genital tract will usually demonstrate the existence of a chronic lesion; the method of examination is dealt with elsewhere (see gonococcal arthritis, etc.).

*Complications.*—The most frequent complication is arthritis, and the most important is endocarditis. Pericarditis, meningitis, peritonitis, pneumonia, pleurisy, iritis, conjunctivitis, thrombosis, and em-

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bolism may also arise and add to the difficulties of treatment.

*Prognosis.*—Apart from the occurrence of complications, the outlook largely depends on the acuteness of the septicæmia. It is nearly always possible to eradicate the local focus and prevent reinfection if the patient's condition is such as to justify surgical intervention. But apart from any reinfection, the resisting power of the blood in some cases is so feeble that the disease proves fatal either rapidly or after a more or less protracted struggle. The prognosis should therefore always be a guarded one in acute cases, because of the difficulty of stimulating the formation of antibodies, and in subacute cases because of the risk of serious complications.

*Treatment.*—Evacuation and free drainage of any abscess cavity, however small, is the first indication, provided that the patient is, in the surgeon's opinion, in a condition to stand the necessary operation. Alcohol is contra-indicated as a stimulant, and reliance in this respect must be placed on strychnine and a sustaining and easily assimilated diet. The temperature may be controlled by cool baths or packs. Vaccine treatment one would hesitate to employ in acute septicæmia where there are indications of failure of the blood to respond to the call on its immunising mechanism, and where any increase in the already pronounced "negative phase" might result in total collapse. An injection of 15–25 cubic centimetres of anti-gonococcus serum, followed if necessary in 24 to 48 hours by a second dose, is more likely to be helpful. The only risk run in this case is that of increasing the patient's discomfort should symptoms of serum-sickness supervene.

In subacute and chronic cases, vaccines are said to have been beneficial.

The colloid silver collargol has been used intravenously in doses of 10 cubic centimetres of a 1 or 2 per cent solution in normal saline daily for three or four days with satisfactory results reported.

## CHAPTER XXIV

### GONOCOCCAL AFFECTIONS OF THE HEART AND BLOOD-VESSELS

It is universally believed that the gonococcus can flourish in the blood of a susceptible individual, the accepted proof being the separation of the organism from the blood of a patient showing symptoms of acute septicæmia. One would expect in view of the characteristic predilection of the gonococcus for epithelial tissue that at least a proportion of septicæmic cases would be associated with involvement of the epithelial lining of the circulatory system, and this is in accordance with the clinical and pathological findings. Endocarditis with more or less myocarditis, pericarditis, aortitis, endarteritis, and phlebitis due to the gonococcus in pure culture have all been frequently demonstrated.

*Endocarditis.*—Ricord (1847) noticed the conjunction of endocarditis with gonorrhœa, and this association was specially emphasised by Brandes in 1854. Thayer and Blumer (1895) cultivated the gonococcus from the blood of a patient suffering from endocarditis. Over two hundred indisputable cases have since been reported, and it is now recognised that the condition of the heart must be watched in every case of posterior urethritis.

*Pathology.*—No clinical or macroscopic feature of gonococcal endocarditis has been described which would differentiate the gonococcal from other forms

of endocardial inflammation. Vegetations composed of fibrin and infiltrated with leucocytes and gonococci, erosions going on to ulceration and valvular destruction, and thrombi are commonly found.

*The diagnosis* is dependent on the isolation of the causative organism. A few cases in which streptococci and staphylococci were found along with the gonococcus have been reported.

*Symptoms.*—In the majority of cases the symptoms are less acute than in ulcerative endocarditis due to other organisms. The temperature rises to 101° or 103° F. in the common type. Dyspnœa, præcordial pain, and palpitation with cardiac dilatation and displacement of the apex beat along with auscultatory signs of a heart lesion are present sooner or later. The endocarditis may be overshadowed by the septicæmia or by arthritis, in which case it would be looked on as a complication of the more prominent condition. Embolic metastasis may involve the spleen, liver, kidneys, brain, etc., but a resulting gonococcal abscess in these situations is rarely found. The lesions are usually confined to the left side of the heart, and embolism in the lungs is therefore very uncommon. An analysis of the reported cases indicates the relative frequency with which the different valves are involved to be as follows :—

Mitral	.	.	.	.	.	48	%
Aortic	.	.	.	.	.	39·7	„
Pulmonary.	.	.	.	.	.	5·3	„
Tricuspid	.	.	.	.	.	2·6	„

Men are more frequently attacked than women, and women are more susceptible during pregnancy or the puerperium.

The etiology and treatment have been discussed under septicæmia.

*Pericarditis* is evidenced by præcordial pain and tenderness, friction, muffled first sound, increased cardiac dullness, and dyspnœa. It is considerably less frequent than endocarditis. The amount of effusion is seldom great, but on a rare occasion it may require to be aspirated in order to relieve the dyspnœa. The point of puncture is to the left of the base of the xiphoid cartilage (Marfan's point). The fluid may be serous, serofibrinous, blood-stained, or purulent.

*Phlebitis*.—The pampiniform plexus of the spermatic cord or of the broad ligament, and the prostatic plexus of veins are the most common areas to be primarily affected. The process may extend especially to the veins of the lower limb, a rare result being thrombosis and gangrene. Several mild cases involving the external saphenous vein and ending in complete recovery have been reported.

*Treatment*.—In addition to treatment of the genital focus and of the septicæmia, complete rest of the affected parts should be secured by appropriate splints and bandages.

## CHAPTER XXV

### GONOCOCCAL SKIN LESIONS

BUSCHKE ("Arch. f. Derm. u. Syph.," 1899, vol. xlviii, p. 181) classifies the cutaneous eruptions associated with gonococcal infection into four divisions :—

1. *Simple erythema*.—Care has to be exercised to exclude all cases which might be balsamic or syphilitic in origin ; but after due allowance has been made for error in this respect there remains a sufficient number to make this the most frequent form of gonococcal eruption. In this group are included the small red papules which occur on the trunk, arms, and thighs, and the typhoid-like rose spots which are sometimes seen in the septicæmic state. The erythema of the external genitals not uncommonly found in women suffering from gonorrhœal discharge is of a different nature, being due to external irritation.
2. *Urticaria and erythema nodosum*, indistinguishable from the ordinary varieties, occur in some cases. There are usually other evidences of a general infection, e.g., arthritis.
3. *Hæmorrhagic and bullous*, exanthems symptomatic of severe septicæmia and possibly due to embolism. Gonococci have been demonstrated in some cases of each of the above three varieties of skin lesion.

4. *Hyperkeratosis*.—This group includes the only variety which can be said to be a specific manifestation of gonococcal infection. It therefore requires more detailed consideration. Various names have been suggested for this affection with more or less reasonableness, but custom has meantime established the term “*Keratoderma blenorrhagica*.”

*Keratoderma blenorrhagica* was first described as a specific disease by Vidal in 1893. Since that date twenty-five cases or more have been reported. Simpson published a very complete article on the subject in the “*Journal of the American Medical Association*,” August 24th, 1912, in which a synopsis of the previously reported cases is given. The first case reported in England was a patient of Dr. J. H. Sequiera (Sequiera and Turnball, “*British Journal Dermat.*,” 1910, vol. xxii, p. 139).

*Etiology*.—Arthritis was a feature of all the published cases except in two reported by Robert. There is thus evidence of systemic infection by the gonococcus, but so far the organism has not been found in the skin lesion. The etiological relationship of the gonococcus to the disease is, however, proved by the presence of a gonococcal infection in every case prior to the appearance of the skin lesion, and by the fact that the cutaneous appearances conform to no other known type of skin disease. Cutaneous scars, e.g., vaccination marks and the skin regions most exposed to irritation (hands and feet), are the sites most liable to be attacked.

*Pathology*.—Baermann showed that the horny growths characteristic of the disease were not true keratoses, but resulted from a parakeratosis, and he therefore proposed the name “*dermatitis papillaris*

parakeritotica." The essential histological feature in addition to the parakeratosis is a leucocytic infiltration deep and epidermic, composed of leucocytes and sometimes mast cells.

*Macroscopic appearance of the lesions.*—The sites of election are the feet and hands, but the eruption may be general and appear on the limbs, trunk, and head. The lesion in its initial stage is usually a small papule or pustule with a raised horny centre, under which is a drop of viscid waxy material composed of leucocytes and desintegrating epithelium. The resulting "scab" projects as a horny conical growth, becoming ultimately not unlike a rupial crust and increasing in size centrifugally. Sometimes the horny nodes are wax-like and translucent. On removing the crust a moist area of reddened skin is left. A diffuse keratosis of the palm or sole is frequently produced with nodes at irregular intervals. The nails may be involved and ultimately exfoliate. The nodes frequently project 1 to 2 centimetres, and measure 2 to 3 centimetres in diameter. A severe balanitis has been a feature of many of the cases. Destruction or ulceration of the skin is never seen. No scarring therefore is found when healing is complete.

*Diagnosis.*—Syphilis must be negatived, as sometimes the lesions simulate a seborrhœa-psoriasis syphilide. The largest and oldest nodes may resemble rupia, but an inflammatory base is lacking.

*Prognosis.*—The skin condition will completely clear up by desquamation and exfoliation if and when the gonococcal infection is cured.

*Treatment.*—Most observers agree that local treatment of the skin is of little or no value. Indeed, those parts left untreated have apparently done better than areas covered with ointments. Simpson, how-

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ever, recommends a sulphur and resorcin ointment. The gonococcal infection is the most important element requiring treatment. Urotropin is credited with determining a rapid cure in one reported case.

*Gonococcal infections of skin wounds* and ulcers have been reported in a few cases. Pustules have been produced by scratching with infected finger-nails and subcutaneous abscesses have in a few cases been found to contain the gonococcus.

## CHAPTER XXVI

### IMMUNITY REACTIONS

*Immunity reactions.*—The immunity reactions which can be excited by the gonococcus in addition to their scientific interest have an important practical bearing on certain methods of diagnosis. But, above all, these reactions require full consideration in any attempt to elucidate the intricacies of vaccine treatment.

The failure of all attempts to produce gonococcal infection in animals has severely handicapped all efforts to study the questions of immunity in their special relationship to the gonococcus. No toxin seems to be elaborated by the gonococcus, but Wassermann and others have shown that there are certain endocellular substances, endotoxins, which when injected into man and animals produce toxic symptoms. Müller and Oppenheim, Bruck and also Vannod (1906) proved that a real immunity reaction does occur in man. They showed, by means of the complement deviation test, that bodies of the nature of amboceptors were present in the blood of patients suffering from general gonococcal infection. Since then a considerable amount of work has been done on the complement deviation phenomenon, on agglutination and opsonic action, the presence of precipitins and bactericidal substances, and finally on skin reactions, all of which substantiate the view that a specific immunity of a complex constitution is elaborated against the gonococcus.

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The future may evolve methods by which agglutination and opsonic action will be in general use as effective guides to the progress of gonococcal infection, but meantime only a few workers can report anything like consistent results with these two reactions.

*Agglutination.*—Vannod (1906), Torrey (1907), Elser and Huntoon (1909) maintain that the three organisms which owing to morphological similarity are capable of being confused (gonococcus, meningococcus, and micrococcus catarrhalis) may be differentiated by agglutination tests, provided that one uses active sera and that one avoids strains that are highly inagglutinable. The results must also be properly controlled, and it should be remembered that the gonococcus is especially susceptible to normal rabbit and group agglutinins. Some strains are apparently inagglutinable; others show spontaneous agglutination. This property of the organisms is also influenced by the culture medium on which they are grown.

*Opsonic action.*—As regards opsonic action similar difficulties are met with. Some strains show spontaneous phagocytosis, while the failure of phagocytosis in others introduces a considerable element of uncertainty. Enough has been said to indicate that these procedures so far as they have been practised are not yet on a sufficiently firm basis to be of practical value in diagnosis or the control of treatment.

*Precipitins.*—Torrey and others have demonstrated that specific precipitins are present in the serum of immunised animals. There is no apparent relationship between the agglutinin and precipitin contents of the serum.

*Bactericidal action.*—Martin (1910) emphasises the difficulties of investigating this subject. These are

mainly due to the tendency of the gonococcus to undergo autolysis in salt solution and to its temperature sensitiveness. His conclusions are :—

1. Normal sera may be bactericidal towards gonococci. Of these tested (guinea-pig, rabbit, cat, human), cat's serum has proved most active.
2. From rabbits inoculated with living cultures of gonococci, bacteriolytic immune-bodies have been obtained which can be reactivated by feebly acting normal sera, a marked bactericidal action resulting. These immune-bodies are relatively specific; thus a reactivated rabbit *v.* gonococcus serum which has a marked bactericidal effect on the gonococcus has only a slight effect on the meningococcus.

Martin's results demonstrate the presence of specific bactericidal immune-bodies in the sera of immunised animals which can be activated by complement (present in normal serum). His evidence so far as it goes suggests that there is a scientific basis for treatment aiming at an increase in the quantity and efficiency of these bodies, but whether this treatment should be by active immunity (vaccines), or by passive (serum), he leaves to the future.

#### COMPLEMENT DEVIATION

As previously mentioned, the Bordet-Gengou reaction, used so successfully by Wassermann in syphilis, has been applied to gonococcal infection by Müller and Oppenheim, as well as several other workers from 1906 onwards, but it is to Schwartz and McNeil, who took practical advantage of the important investigations of Teague and Torrey, that the credit of having

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made this test of clinical value is due. Their procedure and the results obtained in 324 cases are described in the "American Journal of Medical Sciences," May, 1911.

The reaction depends on the circumstances that, in the presence of complement, gonococcal endotoxin (antigen) combines with gonococcal antibodies (patient's serum), and that in doing so complement (guinea-pig's serum) becomes "fixed" or "deviated." That complement has in this manner been deviated can be ocularly demonstrated by the addition to the tube of a "hæmolytic system," the red blood corpuscles of which will dissolve only if free complement is present. The fixation of the complement which occurs if gonococcal antibodies are contained in the patient's serum prevents lysis of the red corpuscles, and a "positive" reaction is then said to have been obtained. The following reagents are therefore required :—

1. *The patient's serum.*—This is obtained by puncturing a vein with a salvarsan needle. About 5 cubic centimetres of blood are required if the original Wassermann quantities are employed in the laboratory, but if one-tenth doses are adopted 1 cubic centimetre of blood is sufficient. The blood is collected in a sterile test tube, allowed to clot, and the serum pipetted off. This serum is inactivated by heating for thirty minutes at 57° C. This temperature destroys the complement, which is thermolabile, but leaves the antibodies unimpaired as these bodies are thermostable.
2. *The gonococcal antigen.*—A stock antigen is prepared by extracting the soluble constituents of as many individual strains of gonococci as

are known. Teague and Torrey showed that different strains of gonococci refuse to react except with their respective antibodies, and they proved that there are at least ten different strains of gonococci. In order to obtain constant and reliable results it is therefore essential that a representative of each strain should be included in the mixed antigen. The admixture of ten separate cultures obtained from ten different sources does not, of course, comply with the requirements and to definitely isolate all the possible strains entails a vast amount of laboratory labour.<sup>1</sup> The various strains having been identified and isolated are subcultured on a simple veal agar, which is neutral to phenolphthalein and contains no added salt. When the colonies have matured (twenty-four to forty-eight hours) a few cubic centimetres of distilled water are added to each tube, and the gonococci either scraped or shaken into suspension. Autolysis of the organisms occurs with great rapidity in distilled water, but to ensure sterility the solution is exposed to a temperature of 55° C. for two hours. Solid particles are separated by means of the centrifuge, and finally by the Berkefeld filter. An antigen so prepared is said to be permanent if kept in a cool atmosphere. When about to be used its tonicity is raised to normal by the addition of one part of 9 per cent sodium chloride solution to nine parts of antigen.

3. *Hæmolytic system*.—Washed sheep or ox blood

<sup>1</sup> Parke, Davis & Co. supply an antigen which has so far given me more uniform results than the stock antigens of my own preparation.

corpuscles in 5 per cent suspension are used in conjunction with the serum of a rabbit, which has been immunised against the corpuscles employed. Fresh guinea-pig serum is the most active complement.

The test is carried out by American bacteriologists somewhat differently from the methods usually adopted in this country, and as I have not yet sufficient experience of the reliability of the results with our method, I will quote the description given by Sophian and refer for fuller details to the original article of Schwartz and McNeil ("American Journal of Medical Sciences," May, 1911).

*"Technic of the test.*—Titrate the antigen to determine the maximum quantity which can be used without inhibiting hæmolysis. Titrate all materials before commencing the test.

*Test:* In the front tubes place .01 cubic centimetre and .02 cubic centimetre serum respectively, in the back control tube place .02 cubic centimetre serum. Complement: .1 cubic centimetre of 10 per cent solution of complement; antigen in maximum quantity; one positive and negative control each with its own separate control.

Incubate one half-hour in water bath.

Add 1 cubic centimetre of 5 per cent suspension of sheep corpuscles, .1 cubic centimetre of anti-sheep amboceptor, equal to two units.

Incubate in water bath one hour and make readings."

Swinburne, from whose clinique most of Schwartz and McNeil's cases were obtained, places great reliance on the test as a means of diagnosis in chronic cases.

Antibodies do not appear in the blood until the fourth week of an acute urethritis, and therefore the test is always negative in a new infection until the expiry of that period. It is thus possible to differentiate between a recurrence and a fresh attack. Torrey reports that the complement fixatives begin to be eliminated in the rabbit about the tenth day after completion of the immunisation, and proceeds rapidly until the fiftieth day. It is probable, therefore, that a positive reaction will result in patients who have been free of gonococci for some time, possibly two months, but the exact time for man has not yet been fixed.

Cases treated with vaccines immediately give a positive result. This justifies the use of vaccines therapeutically, but from what has already been said it will be obvious that either an autogenous vaccine or a mixed vaccine containing the particular offender must be injected. The observation that no antibodies are present in the blood during the first three weeks of an acute gonorrhœa suggests that vaccines should be begun early with the object of preventing complications and hastening resolution.

*Skin reaction.*—The intradermic injection of gonococcus vaccine excites a specific skin reaction which is of diagnostic value. Speaking in April, 1912, I said :—<sup>1</sup>

“ At present we have the method on trial at the Glasgow Lock Hospital. I use a fine hypodermic needle and Ricord syringe, and inject intradermically ten to twenty millions dead gonococci of mixed strains. Care has to be taken to avoid hypodermic instillation of the fluid. The needle is inserted about a quarter of

<sup>1</sup> Transactions of the Medico-Chirurgical Society of Glasgow, 12th April, 1912.

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an inch, and if in the proper stratum, the injection only of two or three drops is possible. As the fluid penetrates between the layers of the skin a white urticaria-like bleb is formed. If there is, or has been, within an as yet undetermined period, a gonorrhœal infection, a specific reaction occurs. An area of intense redness, slightly exceeding in size the above-mentioned bleb, is seen within a few hours. The reaction reaches its maximum in three days; but the area of redness continues with but little subsidence for some days thereafter, and usually begins to fade about the sixth or seventh day, and slowly dies away during the following week or ten days.

The intensity of the reaction varies with the seriousness of the case. When the adnexa are involved the skin reaction is often very marked. In very old-standing cases there is a modified reaction suggestive of the absence of gonococci.

The effect of the injection in a normal individual is, at the most, a slight redness, which reaches its maximum within twenty-four to thirty-six hours, and fades to a barely distinguishable paleness in four to five days.

The modified reaction obtained in post-gonorrhœal cases is between the normal and the specific.

These are the conclusions which seem to be warranted by the work already done, but much greater experience is necessary before the true value of the reaction can be estimated.

Variations in different strains of gonococci probably explain a percentage of misleading negative reactions, and the persistence of antibodies in the blood after all gonococci have been exterminated may explain the occurrence of erroneous positive results. This test, therefore, can only be esteemed as of corroborative value, but within its limits its usefulness is considerable."

## ANTIGONOCOCCUS SERUM

Since the advent of vaccines into the therapeutic arena antigonococcus serum has received but scant attention, the efforts of immunists, perhaps unfortunately, having been concentrated on the effects of vaccine treatment. The serum is obtained from animals (rabbits, goats, sheep, and horses), which have been immunised by injections of increasing doses of gonococcus emulsions. The serum is tested as to its gonococcus antibody content by means of the complement deviation test.

Serum treatment is applicable more particularly to systemic infections, and two or three large doses (15 to 25 cubic centimetres) are required with 24 to 48 hour intervals. Little if any effect is produced on the course of urethritis by serum injection. Serum applied directly to the infected area, having given good results in other diseases, has been tried in gonococcal infection. Sophian suggests that it should be injected into affected joints in gonococcal arthritis.

I have tried vaginal injections of antigonococcus serum in the vaginitis of children without apparent result.

*Auto-sero therapy.*—The withdrawal of fluid from an affected joint and its injection into the neighbouring subcutaneous tissue has been practised with some success.

Normal horse serum and antimeningococcus serum have also been tried in systemic infections, and some favourable results have been recorded.

## GONOCOCCUS VACCINE

The consensus of opinion, judging only from the published articles on the subject of gonococcus vaccine treatment, may be summarised as follows :—

1. Vaccines have no effect on the control of gonococcal urethritis.
2. They may have a curative action on systemic infections.
3. They influence beneficially epididymitis, salpingitis, prostatitis, and other localised and undrained inflammations.

Some good results seem to have been procured, particularly in acute arthritis and epididymitis ; but as the majority of these cases tend to spontaneous cure, scepticism has not been wanting. Indeed, several papers have been published by authors whose opinions carry much weight discounting entirely as a result of their experience the usefulness of gonococcus vaccine, and in addition much adverse criticism is current which is not recorded.

My own experience has been considerable, and it has taught me that vaccine therapy, as at present practised, is as likely to do harm as good. There is something materially at fault with our methods. It is true that profound effects can be produced by vaccine injections, but these results must be so guided that they can be depended on to react to the benefit of the patient before treatment by vaccines can be generally acceptable. Personally, I am quite convinced of the specific power of gonococcus vaccine to modify the disease one way or the other, but I am equally convinced that we have not as yet worked out the data necessary to enable us to use vaccine

with sufficient control over its therapeutic action to justify its indiscriminate employment.

It is possible to put vaccine therapy on a stable basis and to eliminate its inconsistencies and vagaries only by a thorough understanding of the agencies which are involved by our interference with the balance, or rather want of balance, in the natural immunity mechanism, and there are still here dark places on which light needs to be shed.

Whether we fail in dosage, in proper regulation of the intervals, in methods of preparation or administration, or in appreciating the conditions for which it is suitable, has still to be determined. Nevertheless, I am not without hope that future developments will place in our hands a perfected method of stimulating the natural processes of immunity.

## CHAPTER XXVII

### SOCIAL ASPECTS OF GONOCOCCAL DISEASE

BANEFUL as are the effects of gonorrhœa on the individual, the evil does not always end there : many infected persons from ignorance, carelessness, or viciousness fail to restrain themselves from infecting others.

With the growth of the science of public health and the development of the State organisation dealing with it, the question of the administrative control of venereal disease in general is rapidly becoming a pressing question.

There are many aspects of gonococcal infection which make it eminently a suitable field for the activity of the Health Department. It will be granted that it is a contagious disease of a serious nature and widely prevalent, characteristics which should bring it within the domain of sanitary control.

Unfortunately, past efforts on the part of the authorities have been for the most part concerned with the supervision of prostitution, and the difficulties have proved insuperable.

Recently a wise move in the right direction has been made in making ophthalmic neonatorum notifiable. Notification is a necessary preliminary to any real attempt to control the spread of a disease ; but the difficulties which have had to be faced in forcing notification on the profession and the public, in con-

nection first of all with the eruptive fevers and latterly with tuberculosis, are greatly intensified in the case of venereal disease. The imperative demand for secrecy seems at once to make this proposal impracticable. But the necessity for action remains, and some method of control must be formulated which, while respecting the legitimate demand for reticence, will ensure that each case receives efficient treatment, and that infected persons will not with impunity spread the disease.

A campaign of education, free access to skilled treatment without detention, and ultimately confidential notification, is the obvious trend of events.

It is contended that notification would drive an increasing number of patients to unqualified practitioners. But quackery, at least as it affects contagious disease, is an anomaly in a civilised state, and as the Legislature has effectively removed the diseases at present notifiable from the domain of the charlatan, it can be expected to deal similarly with venereal disease once the medical profession has expressed itself as able and willing to undertake its share of the task.

A special State medical service with its own dispensaries and hospitals is undesirable for the treatment of these diseases. The nature of the complaint could not in such case be hidden from friends and relatives. There is no reason why the present general hospitals and dispensaries should not cater directly for this class of patient, nor is there any reason why the private practitioner should not undertake the *cure* of his patients, had he the help of the following legal support :—

1. All persons suffering from symptoms of venereal disease must report in person to a qualified medical practitioner or to a public dispensary.

2. All qualified practitioners will report each case to the Medical Officer of Health on a special form withholding the name and address, but undertaking responsibility for effective treatment and reporting by name and address if the treatment is not satisfactorily carried out by the patient.

The Sanitary Authorities should supply suitable literature for presentation to the patient, and should furnish facilities for diagnostic laboratory tests.

The medical profession would in this scheme be receiving from the State a privilege and a recognition which they have failed to do in the case of any other disease, and in return they would be required to undertake the full responsibility which such recognition merits, that is to say, they must guarantee efficient and thorough treatment.

Any practitioner unwilling to take in hand this work could, of course, refer the case to another.

Many details of such a scheme remain to be worked out, but there is no obstacle which will not ultimately be overcome by the inevitable march of progress.

*Gonorrhœa and marriage.*—When a physician is asked by a patient, who has in the past suffered from gonorrhœa, whether he or she can safely marry, the position is always one of great responsibility and frequently one of considerable doubt. The consequences of error would be so distressing to all concerned that there is no need to labour this point. But a summary of the steps to be taken before giving any advice may be of advantage.

*Rules applicable to both sexes :—*

1. The length of time which has elapsed since the first infection is no guide whatever. Cases

have been recorded where the only possible exposure to infection was as remote as thirteen years, and in my experience I have known infectivity to last up to nine years without reimplantation of the gonococcus.

2. No opinion can be given without a bacteriological examination of each case, as the individual in question may be a "carrier" of the gonococcus without appreciable lesion.

*Method of examining the male.*—The patient presents himself for examination in the morning as soon after rising as possible and without having emptied his bladder. When this cannot be arranged, he must at least have retained his urine for four hours. The meatus is inspected for any signs of discharge. If the lips are found glued together, they are separated and the discharge which is retained in the urethra is expressed on to a sterile slide for microscopic examination. A fine ball-pointed probe tightly wrapped with sterile wool is next inserted into the urethra as far as possible, and, using the utmost gentleness, is rotated and withdrawn. A tube of medium suitable for gonococcus culture is inoculated and immediately transferred to the incubator at 37° C. The same probe is utilised for the making of smears which are stained by the Gram process, and methodically searched for gonococci and other organisms.

The patient now passes urine into three glasses. The first glass will contain any formed fragments of discharge which have been lying in the urethral canal. The second glass will indicate the condition of the bladder, and the last may contain products expressed from the prostatic or ejaculatory ducts in the final contractions of micturition.

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The presence of a minute drop of discharge at the meatus or of shreds in the urine necessitates exploration of the urethra with the acorn-tipped bougie and with the urethroscope to locate the lesion which is present.

The prostate and seminal vesicles should now be massaged and their secretion examined macroscopically and microscopically.

Finally, both epididymes are palpated for nodules, especially in the regions of the globus major and globus minor.

Should the complete examination reveal no evidence of disease and no subjective symptoms be complained of, permission to marry is warranted, but in case of any doubt, one or more of the methods of provoking gonococcal activity may be adopted, and the skin and complement deviation reactions employed.

*Method of examining the female.*—The vulvar glands and crypts as well as the urethra are inspected for evidence of disease as indicated by elevated and reddened areas from which pus can be expressed. The ducts of Bartholin's glands should receive particular attention. The vaginal walls are inspected for areas of erosion and sero-purulent discharge. The cervix is displayed and its condition noted with special reference to ectropion and the presence of discharge. After cleaning away all gross discharge, swabs are taken from the urethra, cervix, and any other suspected locality, culture tubes seeded and smears prepared. The uterus, tubes, and ovaries are palpated bimanually. A specimen of urine should be obtained to complete the examination.

When a thorough examination results in an entirely negative finding, there will be no doubt in

the physician's mind, especially when the systemic tests are invoked and reinforce the decision.

Unfortunately, what will astonish the medical attendant as these examinations become more frequent and more thorough, is the number of cases in which undoubted evidence of continued disease will be disclosed, and treatment called for, before the patient can be absolved from the necessity for delay.

*Prophylaxis.*—While a medical man might justifiably refuse to give information which might in any way encourage the feeling that immorality could be indulged in with impunity, there is no dubiety about his position if consulted within a few hours of exposure to possible infection by a repentant and anxious transgressor. The physician must then be in a position to impart any information to the patient which medical science has at its disposal. As there is now a well-established and reliable prophylactic treatment, this book would be incomplete without at least an outline of its essential features.

The scheme owes its inception to German and French initiative, but has been worked into practical shape by medical officers in the American Navy.

The treatment must be such as will include an efficient preventative for all the venereal diseases. The following summary may be accepted as typical of the methods which have proved successful :—

1. Wash in soap and water, then in solution of 1–1000 to 1–2000 perchloride of mercury for five minutes.
2. Inject 2 to 5 cubic centimetres of 2 or 3 per cent protargol or 5 to 10 per cent argyrol and retain in urethra for five minutes.

3. After drying, massage the skin of the glans, prepuce, penis, and pubis with Metchnikoff's calomel ointment (33 per cent calomel with a base of equal parts of lanoline and vaseline).

If this treatment can be carried out in its entirety within three hours of exposure, safety is almost, if not quite, assured. It is still of value within twenty-four hours of infection, but after forty-eight hours no benefit can be expected.

*Printed instructions for dispensary patients.*—Appended is a copy of the slip given to the patients at the Venereal Dispensary of the Glasgow Royal Infirmary who are suffering from gonococcal infection :—

“ The disease from which you are suffering is contagious.

The infection is in the discharge and it may be carried in towels, clothing, sheets, bath water, water closets, etc.

Your eyes or the eyes of others will become seriously inflamed if any of the poison reaches them, for instance, by failing to wash the hands after handling the parts or by using unclean water for the face.

You must therefore be very careful about cleanliness, and no one must come into contact *in any way* with the discharge.

Avoid all alcoholic drinks and sexual excitement : they will increase the discharge and pain, and seriously delay cure.

Continue attending the dispensary until you are told you are cured, as the infection may still be there even after the discharge has stopped.

Sometimes the disease becomes chronic although showing no symptoms. You should therefore be re-examined before marrying."

A similar sheet with such alterations as will readily suggest themselves is given to women at the Lock Hospital.



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